

**STILL BOTTOMS POND AREA  
IN-SITU SOIL VAPOR EXTRACTION SYSTEM  
CONSTRUCTION COMPLETION REPORT**

**Including On-Site Area Barrier Wall Extraction System Upgrades**

**AMERICAN CHEMICAL SERVICE, INC.  
NPL SITE  
GRIFFITH, INDIANA**

**MWH File No. 2090601**

**Prepared For:**

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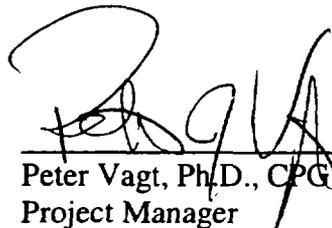


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## ACRONYMS AND ABBREVIATIONS

ACS	American Chemical Service, Inc.
Austgen Electric	Austgen Electric, Inc.
bgs	Below ground surface
Boart Longyear	Boart Longyear Company
BWES	Barrier Wall Extraction System
CCR	Construction Completion Report
cfm	Cubic feet per minute
CPVC	Chlorinated Polyvinyl Chloride
°F	Degrees Fahrenheit
DPE	Dual Phase Extraction
DPT	Direct Push Technology
Fliteway	Fliteway Technologies, Inc.
FRP	Fiberglass-reinforced plastic
ft-lbs	Foot-pounds
GLI	Great Lakes Instruments
Global	Global Technologies
GWTP	Groundwater Treatment Plant
"H <sub>2</sub> O	Inches of water
HASP	Health and Safety Plan
HDPE	High-density polyethylene
HHS	Hard Hat Services, Inc.
hp	Horsepower
HSA	Hollow Stem Auger
IES	Independent Environmental Services
IDEM	Indiana Department of Environmental Management
INDOT	Indiana Department of Transportation
ISVE	In-situ Soil Vapor Extraction
K-P Area	Kapica-Pazmey Area
LEL	Lower explosive limit
MCC	Motor Control Center
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NPL	National Priorities List
OFCA	Off-Site Containment Area
O&M	Operations and Maintenance
ONCA	On-Site Containment Area
PID	Photoionization detector
PLC	Programmable Logic Controller
PPE	Personal Protective Equipment
psi	Pounds per square inch
PVC	Polyvinyl chloride
ROD	Record of Decision

## ACRONYMS AND ABBREVIATIONS (Continued)

rpm	Revolutions per minute
SBPA	Still Bottoms Pond Area
SCADA	Supervisory Control and Data Acquisition
SCBA	Self-contained Breathing Apparatus
scfm	Standard cubic feet per minute
SDR	Standard Dimension Ratio
SVOC	Semi-volatile Organic Compound
U.S. EPA	United States Environmental Protection Agency
UV	Ultraviolet
VFD	Variable Frequency Drive
VOC	Volatile organic compound

## 1.0 INTRODUCTION

This Construction Completion Report (CCR) summarizes the construction of the In-Situ Soil Vapor Extraction (ISVE) system in the Still Bottoms Pond Area (SBPA) of the American Chemical Service, Inc. (ACS) National Priorities List (NPL) Site in Griffith, Indiana from October 2002 to April 2003. This CCR also summarizes the completion of upgrades to the Barrier Wall Extraction System (BWES) in the On-Site Area from September 2002 to July 2003. The United States Environmental Protection Agency (U.S. EPA) Consent Decree identification numbers for the construction of these systems are 2.d. and 3.b.2, respectively.

### 1.1 SITE BACKGROUND

The ACS NPL Site is an operating chemical manufacturing facility. Past operations have impacted five land disposal areas: the On-Site Containment Area (ONCA), the SBPA, the Treatment Lagoon, the Off-Site Containment Area (OFCA), and the Kapica-Pazmey (K-P) Area. The OFCA and K-P Area comprise approximately one-half of the 30-acre site and together they are referred to as the Off-Site Area. The ONCA, SBPA, and the Former Treatment Lagoon are together referred to as the On-Site Area. A site map is shown on Figure 1.

In 1997, MWH installed a 4,400-foot long continuous perimeter barrier wall around the ONCA, the ACS operating facility, the OFCA and the K-P Area. The barrier wall encloses the Site. MWH installed a Separation Barrier Wall within the perimeter barrier wall from January to February 2001. The Separation Barrier Wall provides vertical, hydraulic separation of groundwater minimizing migration of contaminated groundwater between the On-Site Area and the Off-Site Area. The separation wall is keyed into a clay layer approximately 20 feet below ground surface (bgs). Figure 1 shows the locations of the Separation Barrier Wall and the original Barrier Wall installed along the perimeter of the Site.

A groundwater extraction system was installed to maintain hydraulic capture inside the barrier wall. This system is referred to as the BWES. The system is comprised of ten extraction trenches. Extraction wells were installed at the end of each trench to collect the groundwater. One of the main objectives of the BWES is to dewater the On- and Off-Site Areas to allow for effective operation of the ISVE systems. Water collected by the BWES is treated at the on-site Groundwater Treatment Plant (GWTP).

Further information regarding the history of the ACS NPL Site is available in the *Final Remedial Design Report* (Montgomery Watson, August 1999).

## 1.2 IN-SITU SOIL VAPOR EXTRACTION SYSTEM OBJECTIVES

Because the barrier wall already contains the source areas at the Site, the primary objective of ISVE at the ACS Site is reduction of mobile volatile organic compounds (VOCs) in the source areas by extracting VOCs and, to some extent, semivolatile organic compounds (SVOCs). Implementation of ISVE technology is consistent with the objectives of the Final Remedy for the ACS Site, as defined in the Record of Decision (ROD), to address the principle threat by reducing the risk of exposure to contaminated vapors and reducing the potential migration of mobile contaminants to the groundwater.

Applying ISVE to the source areas will decrease the mass of the mobile contaminants within the barrier wall. This reduction, in conjunction with the barrier wall and groundwater pump and treat system, will further reduce the potential for off-site contaminant migration.

In addition, ISVE will reduce the potential for vapor contact through the ground surface by reducing the vapors in the subsurface and it will minimize the VOC loading in the GWTP by removing VOCs before they dissolve into the groundwater.

The objective of the air sparge system in the SBPA is to treat areas of VOC contamination that are below the target groundwater elevation. Air injected by the air sparge system induces volatilization and introduces oxygen into the groundwater to promote biodegradation. When used in conjunction with ISVE, the volatiles stripped from the soil matrix by sparging will be collected by the ISVE system.

Further discussion regarding the design of the ISVE system is available in the *Final Remedial Design Report* (Montgomery Watson, August 1999).

## 1.3 SYSTEM DESCRIPTION

The SBPA ISVE system consists of the following major components:

- Twenty-five ISVE wells
- Twenty-one dual phase extraction (DPE) wells
- Six air sparge wells
- Conveyance piping (for vapor and groundwater)
- Vacuum blower system
- Condensate removal system
- Extracted vapor treatment system
- Controls and Instrumentation

The ISVE blower provides a vacuum at the ISVE wells and pulls the extracted vapors to Building 1 via the conveyance piping. In Building 1, the individual conveyance pipes merge at a header system and are directed through the condensate removal system before entering the blower. During initial operation of the ISVE system, extracted soil vapor is likely to include entrained groundwater. As dewatering in the SBPA progresses with the continued

operation of the On-Site Area BWES and the startup of the DPE wells, which will extract both vapor and groundwater, the quantity of entrained groundwater is expected to decrease. A knockout tank with a demister removes entrained water collected with the extracted vapors. The collected condensate water and the groundwater extracted by the DPE wells is pumped to the GWTP for treatment.

The extracted vapors are then treated by the thermal oxidizer/scrubber system located at the GWTP to remove the contaminants from the vapor stream prior to discharge to the atmosphere. The thermal oxidizer heats the air stream to a temperature high enough to combust the volatile contaminants of the vapor stream. Hydrochloric acid gas, a byproduct of the combustion process, is removed by the scrubber before the treated air is discharged to the atmosphere.

The BWES system was constructed to remove groundwater contained by the barrier wall, thereby, increasing the effectiveness of the ISVE systems by lowered the groundwater levels and exposing soil contamination below the naturally occurring water table.

## 1.4 SCOPE OF WORK

This report documents the completion of the following tasks:

- **Installation of ISVE and DPE Wells and Air Sparge Points.** Twenty-five ISVE wells, 21 DPE wells, and six air sparge points were installed in the SBPA.
- **Construction of the ISVE System Buildings.** Two buildings were installed in the SBPA to house the system mechanical, electrical, and control equipment.
- **Installation of System Piping.** Conveyance piping was installed to connect each ISVE well, DPE well, and air sparge point to the piping manifolds in the system buildings. Air and condensate/groundwater conveyance piping also runs from the system buildings to the GWTP.
- **Installation of Thermal Oxidizer/Scrubber System.** To treat the high concentrations of contaminants in the vapor stream anticipated during the initial operation of the ISVE system, a thermal oxidizer and scrubber were installed at the GWTP.
- **Installation of Controls and Instrumentation.** The ISVE system required installation of controls and instrumentation and integration of the ISVE system operation with the operation of the GWTP.

Information regarding upgrades to the On-Site BWES, including the installation of groundwater extraction pumps in the DPE wells, is integrated into appropriate sections of this report.

The Gantt chart in Appendix A summarizes dates and durations for each of these components.

## 2.0 SUMMARY OF CONSTRUCTION ACTIVITIES

### 2.1 ISVE WELL, DPE WELL, AND AIR SPARGE POINT INSTALLATION

The ISVE wells, DPE wells, and air sparge points were installed in the SBPA to meet the objectives detailed in Section 1.2.

MWH selected Boart Longyear Company (Boart Longyear) of Schofield, Wisconsin to install the wells. The work was conducted from October 24, 2002 to November 15, 2002.

Figure 2 shows the locations of the wells. A photographic log of the well installation is included in Photographs 5 through 9 of Appendix B. Boring logs and well construction diagrams prepared by Boart Longyear are included in Appendix C. Copies of the driller's Indiana Well Driller's Licenses are included in Appendix D.

#### 2.1.1 Well Construction

The drilling locations were surveyed by Area Survey, Inc., of Orland Park, Illinois prior to Boart-Longyear's mobilization to the site. Each location was marked with a stake labeled with the well identification.

The ISVE wells and DPE wells were drilled and installed by hollow-stem auger (HSA) methods utilizing two drilling rigs, a Longyear® BK-66 rig and a Longyear® BK-81 rig. The air sparge points were installed using direct push technology (DPT) methods utilizing a Geoprobe® 5400DT.

10¼-inch diameter boreholes for ISVE well locations were drilled to the specified depth using 6¼-inch inside diameter hollow-stem augers. 12¼-inch diameter boreholes were drilled to the specified depth at the DPE well locations using 8¼-inch inside diameter hollow-stem augers. Geologic characteristics and evidence of free product, if present at the drilling location, were noted. The air sparge points were driven to the target depth utilizing a disposable drive point attached to the casing. Continuous soil sampling was conducted by MWH during the installation of the air sparge points. Continuous soil sampling was not conducted during installation of the ISVE and DPE wells. However, general observations of soil stratigraphy were recorded at some of these locations. This information and the information gathered during continuous soil sampling at the air sparge points is provided in boring logs in Appendix C.

During installation of SVE-46 on November 4, 2002, the augers pierced the three-inch diameter groundwater conveyance pipe installed prior to the well installation. The pipe was repaired at a later date during the system piping installation (Section 2.3.1).

The ISVE and DPE wells were installed to depths ranging from 10 to 22 feet bgs. Installation depths are included on Table 1. The ISVE wells were constructed of four-inch diameter, 304 stainless steel with a screen length of five or 15 feet. The DPE wells were constructed of the six-inch diameter, 304 stainless steel with a screen length of 15 feet.

The riser pipe for the wells extended approximately four to six feet above the ground surface (top of clay component of the interim cover). Expandable well plugs were installed to seal each well to the atmosphere after installation. A sand filter pack was installed to one foot above the top of the screen. Bentonite chips were installed to approximately 2 to 4½ feet above the filter pack and then hydrated. The chips were allowed to hydrate for approximately ten minutes to ensure the formation of a bentonite seal immediately above the filter pack. The remainder of the annular space was then filled with 3/8" bentonite chips to the ground surface.

The air sparge points were installed to approximately 20 feet bgs. The points were constructed of one-inch diameter, 304 stainless steel with a screen length of two feet. The annular space was then filled with granular bentonite to the ground surface.

Construction details for all drilled points are summarized in Table 1. Detailed drawings of typical ISVE and DPE wells and air sparge points are included on Figures 3 and 4.

Upon completion of the interim cover in the SBPA, flush-mount covers were constructed over the DPE wells locations as well as ISVE wells and air sparge points that were located within traffic areas. The riser pipes at these locations were cut off approximately six inches below the top of the clay layer. A manhole cover and a 5.5-foot by 5.5 foot concrete cover was then constructed over the well. Detailed drawings for a typical flush-mount construction, depicting the approximate dimensions of the wellhead installation, are provided on Figures 3 and 4.

### **2.1.2 Contaminated Soils Handling**

During drilling, plastic sheets were placed around each drilling location to prevent contaminated soils from contacting the ground surface. Drilling cuttings and the plastic sheets were collected and stored in a rolloff box. At the end of the drilling activities, the contents of the rolloff box were placed underneath the interim cover in the SBPA. Excavation of existing cover, disposal of drilling cuttings, replacement of cover, and field quality control testing are discussed in Section 2.3.6.

### **2.1.3 Quality Control**

Material testing and quality control measures were followed in accordance with the *Construction Quality Assurance Plan* (Montgomery Watson, June 1999) to assure that the ISVE wells, DPE wells, and air sparge points met the performance requirements. The following quality control measures were executed prior to and during construction:

- Submittal of manufacturer specifications and approval of construction materials, and
- Verification of filter pack depth.

Manufacturer specifications for the materials used during construction were submitted to and approved by MWH prior to construction. The manufacturer's specification sheets are included in Appendix D.

MWH personnel provided full-time oversight during the construction of the wells. MWH activities included verification that the approved materials were used, verification that the materials were not damaged or compromised during installation, verification that the proper documentation was completed, and confirmation that the wells were constructed to the proper depths and dimensions. Well depths and dimensions were verified by auger depth. The depth of the filter pack above the top of the screen was verified using a tape measure.

#### **2.1.4 Health and Safety**

The work associated with the installation of the ISVE wells, DPE wells, and air sparge points was performed in accordance with the site-specific Health and Safety Plan (HASP) and Boart Longyear's HASP submitted to MWH prior to mobilizing to the site.

Prior to beginning work each day, Toolbox Safety Meetings were held with all work crews on site that day. The Boart Longyear project manager or the MWH Site Health and Safety Officer conducted the meetings. Topics at the meetings included identification of the various work crews on site, safety concerns related to the day's activities, general health and safety subjects, and site- and activity-specific protocols.

An exclusion zone was set up at a minimum 30-foot radius around each drilling location. The exclusion zone was expanded if necessary based on air monitoring results. In areas where the drill rigs were relatively close together, a larger exclusion zone was established to encompass both rigs. A contamination reduction zone was set up adjacent to the exclusion zone for personnel decontamination.

Boart Longyear monitored concentrations of VOCs in worker breathing zones and in areas adjacent to the intrusive activities using a photoionization detector (PID). Combustible gases, lower explosive limit (LEL), and oxygen levels were also monitored regularly. MWH personnel were on site throughout the construction activities and conducted regular quality assurance air monitoring along the perimeter of the exclusion zone.

Because of the potential for elevated contaminant concentrations, Boart Longyear personnel performed the work in Level B personal protective equipment (PPE). At a minimum, this included Tyvek protective overalls, plastic boot covers, inner gloves, outer chemical resistant gloves, full-face supplied air respirator, and hard hat. The air was supplied by a cascade air system. A 30-minute self-contained breathing apparatus (SCBA) was available near the work area for emergency situations. All personnel using respirators were required to have current fit testing certification.

## **2.2 CONSTRUCTION OF SYSTEM BUILDINGS**

The SBPA ISVE mechanical and electrical equipment are housed in two prefabricated buildings. Mechanical equipment associated with the ISVE system (vacuum blower, knockout tank, water pump, ISVE piping manifold) are located in Building 1. Electrical and control equipment and mechanical equipment associated with the air sparge system and air supply to the DPE pumps are housed in Building 2.

MWH selected Fliteway Technologies, Inc. (Fliteway) of Greendale, Wisconsin to construct the system buildings. Ryan Construction of Merrillville, Indiana constructed the building foundation slab.

A photographic log of the installation of the system buildings is included in Photographs 15, 16, 21, and 22 in Appendix B. The as-built drawings of the system buildings are included in Appendix F.

### **2.2.1 Foundation**

In preparation for the construction of the building foundation slab, MWH installed transition piping at the location of the buildings. The transition piping consisted of high-density polyethylene (HDPE) 90-degree, pipe sweeps. A copy of the pipe sweep manufacturer's specification is included in Appendix G. The sweeps provide a connection between the piping manifold inside Building 1 and the conveyance piping installed to each well. Section 2.3 provides details of the conveyance pipe installation. MWH mounted 46 three-inch diameter sweeps for the ISVE and DPE wells and six, one-inch diameter sweeps for the air sparge points in November 2002. One-inch diameter HDPE pipe for air supply to the groundwater pumps installed in each DPE well was mounted adjacent to the air sparge pipe sweeps.

Ryan Construction constructed the foundation slab, which measured 25.5 feet wide by 35 feet long by 12 inches thick with 24 inches thick footings around the edges of the slab. Prior to placing the slab, a 14.5 oz. geotextile was placed over the clay and covered by 12-inch to 24-inch thick aggregate subbase. A 6-mil thick plastic vapor barrier was placed over the aggregate subbase. The aggregate used for the subbase was Indiana Department of Transportation (INDOT) #53 aggregate. In-place density testing of the subbase indicated that compaction had achieved 97.8 to 100 percent of the maximum density of 142 pound per cubic foot (pcf), exceeding the specification of 90 percent. The maximum density value was based on a typical range provided by the aggregate supplier. Because the subbase was constructed of aggregate, there was no specification for the moisture content. The results of the in-place density testing are included in Appendix E.

The slab was constructed of concrete with a compressive strength of over 5,000 pounds per square inch (psi) and was reinforced with No. 5 reinforcing bars spaced 12 inches apart. An as-built drawing of the slab is included as Figure 5.

On December 16, 2002, the concrete was poured to form the slab. The concrete was poured around the HDPE sweeps and electrical conduits. During the concrete installation, four cylinder samples of concrete were collected. These were tested for compressive strength by Great Lakes Soils and Environmental Consultants, Inc. (Great Lakes Soils) of Burr Ridge, Illinois after 7, 14, and 28 days. The final 28-day compressive strength tests, conducted on January 13, 2003, demonstrated that the concrete had a compressive strength of 5,690 and 5,700 psi (greater than the original minimum requirement of 5,000 psi). Test results are included in Appendix E.

On April 3, 2003, U.S. Floor Corporation of Skokie, Illinois applied a protective coating to the concrete. The coating, Rock Tred Agua-Rock Clear Part-A, is designed to protect the concrete in the event of leakage from the condensate removal system. The coating is also ultraviolet (UV) resistant. A copy of the protective floor coating manufacturer's specifications is included in Appendix G.

### **2.2.2 System Buildings**

The buildings were constructed off site at Fliteway's Greendale, Wisconsin facility. Building 2 was delivered to the site on May 9, 2003. Building 1 was delivered on May 28, 2003. Both buildings were placed on the same foundation slab using a crane. Building 1 was placed on the north edge of the foundation and Building 2 was placed on the south edge.

Upon delivery, a misalignment of the Building 1 piping manifold and the piping installed with the foundation was discovered. Fliteway representatives were on site from June 5 to June 20, 2003 to adjust the length of the building to accommodate the conveyance piping.

Building 1 is 33 feet, 10.5 inches long, 10.5 feet wide, and 8.5 feet high constructed of steel tube frame on a base frame constructed of 10-inch steel C-channels. The roof is pitched upward 10 inches from the south side of Building 2 to the north side of the building. Building 1 is pitched at the same angle upward from the north side of the building to the south side of the building. The building has a ½-inch plywood exterior, R13 insulation in the walls and ceiling, and exterior vinyl siding. Building 2 is constructed in the same manner and is 24 feet long, 10 feet wide, and 8.5 feet high. The structure was constructed to conform to all applicable building codes.

Because Building 1 houses the equipment associated with the ISVE system and conveys vapors that could potentially be explosive or hazardous, all equipment installed in Building 1 was installed and wired per National Electric Code (NEC) Class 1, Division 2 Hazardous Location requirements. Building 2 contains electrical and control components and equipment associated with the air sparge and DPE pump air supply systems and is, therefore, not rated for hazardous environments.

The ventilation systems for each building consist of a wall-mounted ventilation fan and louvered vents. The fans are controlled by thermostats. Both buildings are heated by electrical convection heaters. The ventilation and heating components installed in Building 1 are rated for NEC Class I, Division 2 environments.

Interior lighting in Building 1 consists of three 150-watt lights rated for hazardous locations. The lights are enclosed in gasketed fixtures. Exterior lights with light-sensitive photo eyes are installed above the access doors on each building. The exterior lights provide automatic dusk-to-dawn operation.

### **2.2.3 Conveyance Piping Manifolds**

The ISVE system piping manifold, located in Building 1, was constructed with six-inch diameter Schedule 80 polyvinyl chloride (PVC) piping. The manifold is divided into

two main headers (one on the north side and one on the south side of the building). The piping from each well, installed in the foundation slab, is connected to these main headers via three branches with another six-inch diameter pipe branch that allows ambient air into the vacuum system. Six-inch diameter manual butterfly valves were installed on each branch to control flow.

The blower effluent piping was connected to one of the eight-inch diameter HDPE conveyance pipes that were extended to the building location. This pipe connects the ISVE system to the thermal oxidizer located at the GWTP (approximately 400 feet away). During fresh air operation, the blower effluent stream can be diverted to the atmosphere through a discharge pipe that leads to the building exterior.

To measure air flow rates, pitot tubes and differential pressure meters were installed on each pipe header. The meters installed on the ambient air header, the combined influent pipe, and the blower effluent pipe are capable of transmitting the differential pressure in the pipe to the programmable logic controller (PLC).

Six-inch diameter Universal-brand silencers were installed on the ambient air header and on the blower effluent pipe. A six-inch diameter, 10-micron in-line filter was installed between the knockout tank and the blower. A Dwyer pressure gauge was installed to measure the differential pressure across the filter element. A Kunkle vacuum relief valve was installed on the inlet side of the blower and a Kunkle pressure relief valve was installed on the blower outlet pipe. Two temperature gauges were installed on the blower influent and effluent piping. A six-inch diameter Spears-brand swing check valve was installed on the ambient air header. This check valve eliminates the potential for system vapors to be released through the header.

A three-inch diameter bypass pipe was installed to supplement the six-inch diameter ambient air header. A solenoid valve controls flow through the pipe.

A Rosemount Series 2088 pressure transducer was installed on the blower effluent piping to measure the pressure at this point and transmit the information to the PLC.

Flexible reinforced PVC hose was used to connect the riser pipes and the manifold system. This hose was installed in June 2003. Each riser pipe has a three-inch diameter, Valterra-brand gate valve, a Dwyer vacuum gauge and a sample port. MWH installed fittings on each riser pipe to facilitate the insertion of a pitot tube for flow measurement.

The pipe manifold for the air sparge system located in Building 2 was constructed of one-inch diameter galvanized steel pipe. The manifold directs flow from the compressor into six pipes, each serving one air sparge point. The galvanized pipe transitions to the HDPE risers inside the building. Dwyer VFC-series variable-area flowmeters and pressure gauges were installed on each of the six individual pipes. Ball valves were installed on each pipe to control flow to the air sparge points.

The pipe manifold for the air supply to the pumps installed in each DPE well was constructed of two-inch and one-inch diameter galvanized steel pipe. The manifold receives air from the main site compressor, installed in the GWTP, via a one-inch line extended to Building 1. This pipe is connected to Building 2 where the manifold directs air flow to five one-inch diameter HDPE pipes (each serving four to five DPE locations). A solenoid valve installed on the two-inch diameter header pipe controls operation of the DPE pumps by allowing air flow to the pumps.

#### **2.2.4 Blower**

The ISVE system blower is a 30-horsepower (hp), positive displacement blower (Hibon Model No. H/V 815). The blower is rated for 1,000 standard cubic feet per minute (scfm) at a vacuum of 95 inches of water ("H<sub>2</sub>O) and a discharge pressure of 23 "H<sub>2</sub>O. The blower is located in Building 1.

The blower was coated with an acrylic urethane coating to provide chemical and abrasion resistance for critical blower parts.

#### **2.2.5 Air Sparge Compressor**

The air sparge compressor is a 7.5-hp, rotary vane pump (Becker Model No. KDT 3.80). The pump is rated for 30 cubic feet per minute (cfm) at a discharge pressure of 17.8 psi. The air sparge compressor is located in Building 2.

#### **2.2.6 Entrained Water Knockout Tank**

A 500-gallon (300-gallon fluid capacity) stainless steel knockout tank is located in Building 1. The tank has a removable top cover and an internal demister element. A sight glass installed on the exterior of the tank allows visual observation of the water level in the tank. A drain port with a manual ball valve is located near the base of the tank. MWH installed a Magnetrol Eclipse-series level transmitter in the knockout tank in October 2003. This probe transmits the tank level to the PLC. The PLC uses the water level information to control operation of the transfer pump. Secondary containment for the knockout tank is provided by a retaining tank constructed below the building floor in the area beneath the knockout tank. The retaining tank is capable of holding 110percent of the knockout tank's capacity, (330 gallons).

#### **2.2.7 Transfer Pump**

A Moyno-brand progressive cavity, explosion-proof pump with a one-horsepower motor is mounted next to the knockout tank in Building 1. The pump transfers water from the knockout tank to tank T-102 located in the GWTP on command from the PLC.

#### **2.2.8 Quality Control**

Material testing and quality control procedures were followed in accordance with the *Construction Quality Assurance Plan* (Montgomery Watson, June 1999) to assure that the equipment used in the system buildings met the applicable performance requirements.

Manufacturer specifications for the materials used during construction were submitted to and approved by MWH prior to construction. The equipment manufacturers' specification sheets are included in Appendix G.

### **2.2.9 Health and Safety**

The work associated with the installation of the ISVE wells, DPE wells, and air sparge points was performed in accordance with the site-specific Health and Safety Plan (HASP). To minimize the potential exposure to vapors, the following health and safety procedures were followed when installing conveyance piping in Building 1:

1. The caps on all of the SBPA ISVE wells were removed and the pipes left open for several days to allow the pipes to vent and equilibrate with the ambient air.
2. Prior to beginning the actual connection work, the pipe stubs were opened one by one. After each pipe stub was opened, a power ventilator was used to blow any remaining vapors back to the well head. Once this was done, the pipe stub was monitored using a photoionization detector (PID).
3. The building was vented with a portable vent fan during all work activities and MWH personnel, with 40-hour OSHA HAZWOPER certification, were present during the work, monitoring the area with a PID. Air monitoring performed during the work activities did not indicate the presence of VOCs.

Safety meetings were held before the placement of each of the buildings to ensure that the personnel involved with the installation were aware of the hazards involved with the crane lift. The procedure for the building installation was detailed in the safety meeting and the potential hazards were also discussed. In addition, the procedures for eliminating or reducing the potential of these hazards (i.e. allowing only key personnel into the area of the crane lift, maintaining visual contact with the crane lift, maintaining communication between the laborers and the crane operator, etc.) were discussed.

## **2.3 SYSTEM PIPING INSTALLATION**

Installation of the system piping consisted of the following tasks:

1. Extension of existing header piping,
2. Installation of groundwater conveyance piping to each DPE well,
3. Installation of conveyance piping to each ISVE/DPE well, and
4. Installation of air supply piping to air sparge points and to groundwater pumps installed in each DPE well.

A Photograph Log of the installation of the conveyance piping is included in Photographs 10 through 14 in Appendix B.

### **2.3.1 Header Extension and Groundwater Conveyance Piping Installation**

MWH subcontracted Hard Hat Services, Inc. (HHS) of Naperville, Illinois to extend the existing headers and install the groundwater conveyance piping. The installation was performed as part of the construction of the interim cover in the SBPA. Installation of the groundwater conveyance pipe began on September 30, 2002 and was completed on October 10, 2002.

Eight existing conveyance pipes were extended from the GWTP into the SBPA. These conveyance pipes consisted of two eight-inch diameter, one three-inch diameter, and five two-inch diameter HDPE pipes. The eight-inch diameter pipes and the two-inch diameter pipes were extended 290 feet from their existing location, the western edge of the perimeter barrier wall, to the proposed location of the Building 1. The three-inch diameter pipe was installed in a loop around the perimeter of the ISVE well field, near each DPE well, as shown in Figure 6. A two-inch diameter pipe was installed between three DPE wells (SVE-61, SVE-63, and SVE-65) located in the center of the well field and the proposed Building 1 location. Connections with each of the perimeter DPE wells were made to the 3-inch pipes at a later date (see Section 2.3.2 below).

The main trench from the GWTP to the Building 1 was excavated to a depth of approximately 4.5 feet as shown on the detail on Figure 7. The perimeter trench was excavated to an appropriate depth so that the conveyance pipe had a minimum cover of 32 inches. A detail of these trenches is shown on Figure 7.

Drum carcasses and other debris were encountered at two locations while excavating the perimeter trench for the three-inch conveyance pipe loop. The first location was directly south of the ACS Break Room Building on the north edge of the cover area as shown on Figure 6, where several drum carcasses were removed while excavating in this area. Visual inspection of this area indicated that more drum carcasses and debris would need to be removed and relocated if the pipe was to be installed as planned. Therefore, to avoid exposing and potentially relocating additional debris, the pipe trench was installed closer to the ACS Break Room Building than initially planned as shown on Figure 6.

The second area where drum carcasses and debris was encountered was in the northeast corner of the cover area where debris was observed at approximately two feet bgs. Due to the potential for uncovering more debris and in order not to disturb the drum carcasses and debris already encountered, the pipe in this area was installed at a depth of approximately one and a half feet bgs. Because the piping runs in a loop, no pumps would be isolated if freezing occurs in the shallower pipe section. Therefore, the shallower pipe placement is considered to be acceptable.

Drum carcasses and debris were also encountered while installing the three-inch pipe in the center of the cover area. The drum carcasses and debris that were excavated during the piping installation were buried beneath the subbase in west end of the cover area as shown on Figure 6.

On November 21 to November 22, 2002, Independent Environmental Services, Inc. (IES) of Crestwood, Illinois repaired a section of the three-inch pipe that was damaged during the installation of the SVE-46. Following the repair, the pipe was satisfactorily pressure tested.

### **2.3.2 Extracted Vapor Conveyance and Air Supply Piping Installation**

MWH subcontracted IES to install the conveyance and air supply piping. Installation began on November 21, 2002 and was completed on April 24, 2003. Copies of the manufacturer's specifications for the conveyance piping and associated appurtenances are included in Appendix I.

Three-inch diameter Standard Dimension Ratio (SDR) 11 HDPE pipe was laid between each ISVE well and Building 1. One-inch diameter SDR 11 HDPE pipe was laid to each air sparge point and DPE well (for air supply to the well pumps).

Both the three-inch and one-inch diameter pipes were installed above the clay and geotextile layers of the cover. This modification to the design presented in the Final Remedy was made to avoid damage to the clay layer, which would have occurred if the pipes were placed in trenches.

While access to much of the ISVE wellfield will be restricted, truck traffic will be allowed in certain areas. An eight-inch thick layer of concrete with reinforcing welded wire fabric was constructed around all pipes located in these areas to protect them from damage by the weight of the trucks. In all other areas, the pipes were protected by a geotextile fabric. The concrete cover was constructed on March 21 and 24, 2003. Detail A on Figure 8 shows the cross-section of the concrete cover. During the concrete pour, eight cylinder samples of concrete were collected. These were tested for compressive strength by Great Lakes Soils. The final 28-day compressive strength tests demonstrated that the concrete had a compressive strength greater than the minimum requirement of 5,000 psi. Test results are included in Appendix H.

The piping was fused via the thermal butt-fusion technique using a hydraulic fusion machine. Procedures for fusion of the piping and fittings conformed to the specifications of the piping manufacturer.

The pipe was first fused to the end of the pipe sweeps installed within the foundation of the system buildings. The pipe sweeps were numbered to coordinate the routing of the piping along the trenches. Pipe sections were fused together and run to each ISVE well and air sparge point. The runs were designed and installed to minimize crossover of the pipe and low points, which would result in areas where condensate could collect and restrict air flow. Figure 9 shows the layout of the conveyance piping.

### **2.3.3 Pressure Testing**

Each pipe was pressure tested to verify the integrity of the pipe and the pipe welds. An air compressor was connected to either the flange connection at the well end of the pipe or at the termination inside the system building. A blind flange was attached to the other end. A pressure of 95 psi was applied to the vapor conveyance piping and 150 psi was applied to the compressed air piping. The two- and three-inch diameter groundwater conveyance piping was pressurized to 90 psi. The air compressor located in the GWTP and a portable air compressor capable of achieving higher pressures were utilized during this process. This pressure was held for fifteen minutes without deviating more than 2 percent to be considered

passing. While pressure testing the eight-inch diameter pipes, it was determined that the gasket on the pressure coupling could not hold more than 60 psi before the gasket would fail which presented a potential health and safety concern. Therefore, it was determined that the eight-inch diameter lines would be pressure tested at 50 psi for 30 minutes. MWH personnel observed each of the pressure tests. In each test, the pressure remained constant in the sealed pipe indicating the piping was free of leaks.

#### **2.3.4 Connection to Wells**

From November 21 to December 10, 2002, IES connected each DPE well to the three-inch diameter groundwater conveyance pipe. The connection of the groundwater conveyance pipe to the well consisted of running a section of one-inch diameter HDPE pipe from the main three-inch diameter conveyance pipe to the well. The one-inch diameter pipe was connected to the well with a transition fitting and a pitless adapter. In order to make the connection, the clay and soil around each well was excavated to the depth of the pipe.

The vapor conveyance pipes were then attached to each ISVE and DPE well (3-inch diameter). A three-inch diameter hole was drilled into the stainless steel casing of each ISVE and DPE well for connecting the vapor conveyance pipe. For the DPE wells, a 1-inch diameter hole was also drilled in the well casing for the installation of the air supply line to the pneumatic pumps as shown in Figure 4.

Compressed air is supplied to each air sparge point through a 1-inch diameter HDPE pipe connected to the air sparge points using a stainless steel tee and brass ball valve.

Because of concerns of potentially explosive atmospheres in the well and the potential for sparking from the drilling, the atmosphere in each well was inerted by continuously injecting nitrogen into the well. To do this, an inflatable "muni-ball" was lowered into the well immediately below the drilling point. The "muni-ball" was inflated to approximately 20 psi to seal the upper part of the casing from the screened portion. Then nitrogen gas from a cylinder was introduced into the well, inerting the portion of the well to be tapped.

The atmosphere inside the well was monitored for oxygen level and LEL using a multi-gas indicator and for total organic vapors using a PID. Readings indicated the sealing and purging of the well was successful in eliminating explosive conditions.

An HDPE flange adapter with a stainless steel backup ring was fused on the end of each pipe and connected to the well using a stainless steel saddle assembly. The saddle assembly consisted of the saddle, a 12-inch long, stainless steel pipe nipple, and a stainless steel flange. This flange was attached to the backup ring connected to the HDPE conveyance pipe. Photographs 18 and 20 in Appendix B show the assembled saddle connections. Connection bolts were inspected to confirm they were tightened to a minimum torque level of 75 foot-pounds (ft-lbs). For the ISVE and DPE wells, the saddles were installed below the bottom of the clay layer. The one-inch diameter compressed air piping was installed to the DPE wells at the surface of the clay layer using a custom-fabricated flange assembly. This assembly was a stainless steel bulkhead fitting fabricated by Diversified Products Manufacturing in

Oroville, California. The fitting forms an airtight seal around the casing of the DPE well by compressing a polyurethane seal. The manufacturer's illustration of the fitting is included in Appendix I.

Typical details of the pipe-to-well connections are shown on Figures 3 and 4.

### **2.3.5 Backfill and Compaction**

Following the completion of the well connections, the excavated clay was backfilled over the pipe in three to five lifts of approximately three inches and compacted using a jumping jack compactor. In areas where potentially contaminated soil beneath the clay was encountered during excavation, the contaminated soil was placed into the trench prior to backfilling the clay.

The annular space around each well casing was filled with bentonite. To prevent the clay compaction process from disturbing the bentonite seal, the bentonite was contained around the well casing using cardboard tubes. The soil and clay was then backfilled against the cardboard tube and compacted.

Compaction and moisture testing was performed at a frequency of one test for every ten wells. Great Lakes Soils performed the compaction and moisture content testing of the clay. Results of the testing are included in Appendix H. All tests indicated a compaction of 95 percent or greater of maximum dry density, as determined in accordance with ASTM D698, standard proctor compaction test dated September 2, 2002. A copy of this soil testing is included in Appendix H.

### **2.3.6 Contaminated Soils Handling**

Contaminated soils, drum carcasses, and debris that were produced during installation of the system piping and wells were placed in roll-off boxes and covered with plastic sheets. Daily monitoring performed around the roll-off boxes with a PID confirmed that vapors were not being emitted by the contaminated soils. Air monitoring logs were not maintained during this portion of work.

On December 17, 2002, the contaminated soils, drum carcasses and debris were placed underneath the clay cover in the area shown on Figure 6. A 40-foot by 90-foot section of the clay cover was removed and stockpiled. The spoils were placed in the area and compacted using a drum roller. The clay was then placed over the spoils in two, six-inch lifts and compacted. The thickness of each lift was verified using a surveyor's level and rod.

Field density testing was performed on each lift at two locations. The criteria used to evaluate the results were based on the Proctor results collected during the construction of the SBPA Interim Cover. The criteria were +0 to +2percent of OMC and greater than 95percent maximum dry density. Testing indicated the two tests conducted on the first lift were adequate. The tests conducted on the second lift indicated moisture contents were 17.3percent and 17.2%, greater than the established criteria. Because the results for these two tests satisfied the density criterion and because moisture contents only slightly exceeded

the density criterion, MWH accepted the test results based on density only. The locations of the test are shown on Figure 6. The results are included in Appendix H.

### **2.3.7 Material Testing and Quality Control**

Material testing and quality control measures were followed in accordance with the *Construction Quality Assurance Plan* (Montgomery Watson, June 1999) to assure that the piping met the performance requirements. The following quality control measures were executed prior to and during construction:

- Submittal of manufacturer specifications and approval of construction materials,
- Observation of thermal butt fusion process,
- Verification of integrity of HDPE pipe via pressure testing,
- Testing of clay percent compaction and moisture content, and
- Torque-testing of the well saddle bolts.

Manufacturer specifications for the materials used during construction were submitted to and approved by MWH prior to construction. The manufacturer's specification sheets are included in Appendix I.

MWH regularly observed the thermal butt-fusion process to verify construction procedures were being followed. During cold weather, particular attention was paid to the temperature of the welding equipment to confirm it was maintained at or above the recommended temperature.

The integrity of the pipe welds and connections was verified by pressure testing. A pressure of 95 psi was applied to the vapor conveyance piping and air sparge piping and 150 psi was applied to the compressed air piping to the DPE wells. The two and three-inch diameter groundwater conveyance pipes were pressurized to 90 psi. The various pressures were held for 15 minutes without deviating more than 2 percent. While pressure testing the eight-inch diameter pipes, it was determined that the gasket on the pressure coupling could not hold more than 60 psi before the gasket would fail. Because this presented a potential safety concern, the pressure was reduced to 50 psi and the duration of the tests were increased to 30 minutes. MWH personnel observed each of the pressure tests and confirmed that all tests satisfactorily met requirements. A table summarizing the results of the pressure tests is provided in Appendix H.

Upon backfill and compaction of the clay layer, Great Lakes Soils tested the clay to determine if compaction and moisture standards were met. To determine the density and optimum moisture content of the clay, Great Lakes Soils utilized results from a Proctor sample of the clay collected on September 4, 2002 during the construction of the clay cover. Compaction standards were a minimum 95 percent of the Maximum Proctor Density of 112.0 pounds pcf at zero to plus two percent of optimum moisture content of 15.0%. The results of the Proctor test and subsequent compaction testing results are included in Appendix H.

The areas of clay that were excavated and recompacted around each well were relatively small, typically approximately four feet in diameter. Based on the experience from working with the clay during the cover installation, MWH determined that meeting the moisture standard in these areas would require additional excavation that might damage the installed pipe or compromise the integrity of a larger portion of the clay cover. Also, the moisture content of the clay would have little effect on the hydraulic conductivity of the compacted clay as long as the specified density was achieved. Therefore, a subjective evaluation of the moisture content was performed prior to placement of the clay. The clay was considered to have sufficient moisture if it did not clump and was easily workable. Therefore, although the moisture results are presented on the forms in Appendix H, they were not considered during evaluation of the tests. All tests indicated a Proctor density of 95 percent or greater.

Tightening of the bolts on the well saddles was performed using a torque wrench. MWH field personnel observed this process and confirmed the minimum torque applied was 75 ft-lbs.

### **2.3.8 Health and Safety**

The work associated with the installation of the conveyance piping was performed in accordance with the site-specific HASP and the HASP submitted to MWH by HHS, prior to mobilizing to the site. IES performed their portion of the conveyance pipe installation and well connections under HHS' HASP for the SBPA interim engineered cover.

Toolbox Safety Meetings were held each morning with all personnel on site for the day prior to beginning work. The MWH Site Health and Safety Officer conducted the meetings. Topics discussed at the meetings included identification of the various work crews on site, safety concerns inherent to the day's activities, general health and safety subjects, and site-specific safety protocols.

Regular air monitoring was conducted throughout the installation of wells, excavation of the trenches, and connection to the wells. The subcontractors continuously monitored concentrations of VOCs in worker breathing zones and in areas adjacent to the activities using a PID. Prior to drilling into the well casings to connect the associated piping, the well was rendered inert using nitrogen gas. When drilling into the well casing, the atmosphere inside the well was monitored for oxygen level and LEL using a multi-gas indicator and for total organic vapors using a PID. Personal protective equipment (PPE) was worn as required and in accordance with the HASPs. MWH personnel were on site throughout the construction activities and conducted regular air monitoring along the perimeter of the exclusion zone. MWH's readings were recorded in a field notebook.

## **2.4 INSTALLATION OF THERMAL OXIDIZER/SCRUBBER SYSTEM**

A recuperative thermal oxidizer and scrubber system was installed at the GWTP to treat the vapors from the SBPA ISVE system.

An induced draft system fan pulls air flow through the oxidizer/scrubber system. The fan has a 3,740 cfm capacity, with a 30 hp motor at 1,800 revolutions per minute (rpm) and was manufactured by Ceilcote. The fan is controlled by a VFD that modulates the speed of the blower to maintain near static pressure in the influent piping.

A shell-and-tube heat exchanger preheats the process air before it enters the oxidizer's combustion chamber. The heat exchanger is constructed of Alloy 600 steel tubes through which the cool influent air flows. The exhaust air from the combustion chamber flows over the outside of the tubes.

The combustion chamber is constructed of carbon steel. The interior side of the carbon steel shell is coated with a corrosion-resistant Thortex coating. The interior of the reactor is lined with nine inches of ceramic fiber insulation anchored with Hastelloy pins.

The temperature in the combustion chamber is controlled by a natural gas burner system. The temperature can typically range from 1,500 degrees Fahrenheit (°F) to 1,700 °F. The temperature is maintained at the set point by a Honeywell controller. This controller modulates the firing rate of the Maxon burner through a series of control valves, regulating valves, and pressure switches on the gas train and by a modulating combustion air valve. The combustion air valve regulates air flow from the combustion fan to the burner. The combustion fan is a 600-cfm, 5-hp fan manufactured by Twin City Fan.

Thermocouples were installed in the combustion chamber and heat exchanger effluent to monitor temperatures throughout the unit. The thermocouples are 12-inch long dual-element thermocouples and 48-inch triple-element thermocouples manufactured by Pyromation.

#### **2.4.2 Scrubber**

Heated air exits the oxidizer through a 22-inch diameter duct constructed of Hastelloy C276. Flow enters the scrubber system through the quench header where the temperature of the air is reduced by three spray bars constructed of Hastelloy.

The main structure of the scrubber is constructed of fiberglass-reinforced plastic (FRP). A sump at the base of the structure stores recirculation water. The tower above the sump contains the packing media (Ceilcote Tellerette Type K#2 chlorinated polyvinyl chloride (CPVC) spheres) and contains a polypropylene de-mister to remove entrained water droplets. The packing ensures intimate mixing of the process air with the recirculation water.

A three-hp Ansimag centrifugal pump circulates the water from the scrubber sump up to the quench spray header and the recirculation spray headers, installed above the packing media. The water is sprayed down across the top of the packing media where the hydrochloric acid gas is absorbed by the water.

The main blower is installed on a platform constructed above the scrubber. The system stack is also mounted on the platform and extends vertically through the roof of the GWTP. The system exhaust stack, is constructed of 18-inch diameter, FRP pipe. The stack was installed to a height of 35 feet above grade.

The water level in the scrubber sump is monitored by a Magnetrol Kotron RF Sensing Probe. The sump has an overflow pipe located immediately below the quench header. Recirculation flow is measured by a Hayward Series 2000 flow sensor.

The hydrochloric acid transferred to the scrubber water is neutralized by the addition of sodium hydroxide via a Milton Roy caustic metering pump. This pump transfers the sodium hydroxide from the existing storage tank (Tank T-8). The pumping rate is controlled by a Great Lakes Instruments (GLI) pH transmitter. The pH analyzer (sensor) is mounted in an isolated pipe loop.

The continuous neutralization of the hydrochloric acid in the scrubber water produces sodium chloride. The concentration of sodium chloride is measured by a GLI Conductivity Sensor. When this concentration rises above a setpoint, the PLC directs a solenoid valve to open, releasing water from the scrubber system to the gravity phase separator tank (T-101) where it enters the treatment process of the GWTP. This is called the blowdown process. The volume of blowdown water is tracked by a totalizing flow meter. Makeup water is added to the scrubber via another solenoid valve. The effluent water from the GWTP is used as makeup water in the scrubber unit.

Similar to the thermal oxidizer, the temperature in the scrubber is measured by a 12-inch long, Pyromation dual element thermocouple and reported to the PLC.

### **2.4.3 Control Panel**

The control panel for the thermal oxidizer/scrubber system is mounted inside the GWTP. The main components, mounted inside a National Electrical Manufacturers Association (NEMA) 4 Hoffman enclosure, include:

- An Allen-Bradley SLC 5/05 PLC capable of transmitting data to the GWTP Supervisory Control and Data Acquisition (SCADA).
- An Allen-Bradley Panelview 1000 operator interface.
- The General Electric/Fuji VFD (installed separately in the GWTP electrical room).
- A Honeywell circular chart recorder with three inputs. System parameters recorded on the charts are combustion chamber temperature, scrubber temperature, and air flow rate.

### **2.4.4 System Operation**

Operation of the thermal oxidizer/scrubber system is interlocked with the operation of the ISVE blower and its components. A description of system operation is included in the Sequence of Operation provided by Global and included in Appendix J.

### **2.4.5 Startup**

A Global technician was on site from May 12 to May 27, 2003 to supervise the installation, prepare the system for process gas flow, and perform the initial startup. Global also provided system operation training to MWH personnel.

Normal operation of the thermal oxidizer/scrubber system began on May 23, 2003. At this time, the system treated vapors from the Off-Site Area ISVE System only. Treatment of vapors from the SBPA ISVE system began on July 7, 2003.

On May 27, 2003, Global collected influent and effluent air samples from the thermal oxidizer/scrubber system to confirm the units were achieving adequate destruction efficiencies. The analytical results, included in Appendix K, indicated destruction efficiencies for the compounds analyzed were 99.9 percent or greater, exceeding the established performance standard of 95 percent. Also, the results indicate the system discharge of total VOCs to the atmosphere was 0.00088 pounds per hour (lbs/hr) and did not exceed the three lbs/hr limit established by Indiana Department of Environmental Management (IDEM) state compliance regulations.

## **2.5 CONTROLS AND INSTRUMENTATION**

MWH contracted Austgen Electric, Inc. (Austgen Electric) of Griffith, Indiana to install electrical power, control wiring, the motor control center and the PLC for the ISVE system. Austgen Electric installed power poles in the On-Site Area between the GWTP and the system buildings on April 3 and 4, 2003. On May 9, 2003, Austgen Electric ran overhead powerlines from the GWTP to the Building 2 on these power poles. Austgen Electric also completed electrical and control connections between the system buildings and between the system buildings and the GWTP during May and June of 2003.

As-built drawings prepared by Austgen Electric are included as Appendix L. Manufacturer specifications for the major control and electrical equipment were submitted to and approved by MWH prior to construction. The manufacturer's specification sheets are included in Appendix M.

### **2.5.1 Motor Control Center**

The motor control center (MCC) for the SBPA ISVE system equipment was installed by Austgen Electric by May 29, 2003. The MCC is housed in Building 2 and contains disconnects and starters for ISVE and air sparge system equipment.

### **2.5.2 Programmable Logic Controller**

The ISVE system PLC is located in Building 2. . Austgen Electric installed the PLC in May 2003. The PLC is an Allen-Bradley SLC5/05 1747-L551 controller with Allen-Bradley 1746 Series Input/Output modules. The PLC has an interface touchscreen mounted on the exterior

of the panel. The touchscreen is a Maple Systems HMI1520C PLC Controller Interface. In addition to allowing the operator to start and stop the ISVE blower, the screen displays the following ISVE system parameters:

- Thermal oxidizer chamber temperature
- Differential pressures as measured by pitot tubes on various system headers
- Pressure at the effluent of the ISVE blower
- Run status of transfer pump, ISVE blower, and thermal oxidizer

The PLC is connected to the GWTP's SCADA system via a fiber optic cable. All system data can also be viewed via the GWTP SCADA computer. Control of the ISVE blower is also available at the SCADA computer.

### 3.0 REFERENCES

- Montgomery Watson. *Construction Quality Assurance Plan (CQAP)*. June, 1999.
- Montgomery Watson. *Final Remedial Design Report*. August, 1999.
- MWH. *Operation and Maintenance Manual for the Groundwater Treatment Plant*. February 2002.
- MWH. *Separation Barrier Wall Installation Construction Completion Report*. March, 2002.
- Ceilcote Air Pollution Control. *Operation & Maintenance Manual for SPT-36-60 Scrubber System*. March 2003.
- Global Technologies. *Operation & Maintenance Manual for Oxidizer Unit TH20624 (Vol 1)*. August 2003.
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## **TABLES**

**Table 1**  
**ISVE Well and Air Sparge Point Construction Details**  
**SBPA**  
**ACS NPL Site**  
**Griffith, Indiana**

Well ID	Location		Description	Head Detail	Well Diameter (in.)	Top of Casing Elevation (ft. amsl)	Total Depth of Well (Measured from Top of Casing) (ft.)	Screen Length (ft)	Bottom of Screen Elevation (ft. amsl)
	Northing	Eastings							
SVE- 43	7015.0	5403.7	Dual-Phase	flush	6	641.36	20.58	15	620.8
SVE- 44	6986.1	5392.1	ISVE only	stick-up	4	646.39	15.00	5	631.4
SVE- 45	6968.0	5447.1	ISVE only	stick-up	4	645.91	25.00	15	620.9
SVE- 46	6997.1	5470.5	Dual-Phase	flush	6	641.42	20.30	15	621.1
SVE- 47	6956.3	5514.9	Dual-Phase	flush	6	641.49	20.20	15	621.3
SVE- 48	6935.1	5547.7	Dual-Phase	flush	6	641.82	21.15	15	620.7
SVE- 49	6913.8	5591.0	Dual-Phase	flush	6	641.32	21.32	15	620.0
SVE- 50	6940.4	5365.7	Dual-Phase	flush	6	643.22	21.72	15	621.5
SVE- 51	6930.6	5415.6	ISVE only	stick-up	4	647.09	15.00	5	632.1
SVE- 52	6905.5	5449.1	ISVE only	stick-up	4	647.18	15.00	5	632.2
SVE- 53	6904.6	5504.3	ISVE only	flush	4	642.93	11.31	5	631.6
SVE- 54	6875.4	5556.2	ISVE only	flush	4	642.41	11.31	5	631.1
SVE- 55	6857.3	5590.8	Dual-Phase	flush	6	641.62	21.52	15	620.1
SVE- 56	6800.0	5622.8	ISVE only	stick-up	4	645.40	15.00	5	630.4
SVE- 57	6781.5	5664.6	Dual-Phase	flush	6	640.66	20.99	15	619.7
SVE- 58	6903.7	5318.7	Dual-Phase	flush	6	642.50	20.71	15	621.8
SVE- 59	6908.6	5381.9	ISVE only	stick-up	4	647.53	15.00	5	632.5
SVE- 60	6856.4	5404.5	ISVE only	stick-up	4	647.23	15.00	5	632.2
SVE- 61	6869.4	5445.0	Dual-Phase	flush	6	642.83	22.37	15	620.5
SVE- 62	6856.5	5480.3	ISVE only	flush	4	643.26	11.66	5	631.6
SVE- 63	6813.2	5502.5	Dual-Phase	flush	6	642.40	22.60	15	619.8
SVE- 64	6828.1	5540.5	ISVE only	stick-up	4	646.60	15.00	5	631.6
SVE- 65	6774.1	5560.0	Dual-Phase	flush	6	642.45	22.76	15	619.7
SVE- 66	6804.0	5590.1	ISVE only	stick-up	4	645.66	15.00	5	630.7
SVE- 67	6769.8	5609.7	ISVE only	stick-up	4	646.25	15.00	5	631.3
SVE- 68	6752.0	5652.5	ISVE only	stick-up	4	645.70	15.00	5	630.7
SVE- 69	6745.0	5677.4	Dual-Phase	flush	6	640.38	20.65	15	619.7
SVE- 70	6865.1	5348.1	ISVE only	stick-up	4	646.77	15.00	5	631.8
SVE- 71	6823.0	5364.5	ISVE only	stick-up	4	645.80	15.00	5	630.8
SVE- 72	6801.7	5420.4	ISVE only	flush	4	642.30	10.78	5	631.5
SVE- 73	6767.2	5485.7	ISVE only	stick-up	4	646.19	15.00	5	631.2
SVE- 74	6748.7	5523.2	ISVE only	stick-up	4	646.23	15.00	5	631.2
SVE- 75	6722.4	5568.1	ISVE only	stick-up	4	645.50	15.00	5	630.5
SVE- 76	6720.1	5619.0	ISVE only	stick-up	4	645.92	15.00	5	630.9
SVE- 77	6681.1	5622.2	Dual-Phase	flush	6	639.64	20.54	15	619.1
SVE- 78	6699.3	5658.1	Dual-Phase	flush	6	640.45	20.04	15	620.4
SVE- 79	6803.2	5343.5	Dual-Phase	flush	6	639.55	20.51	15	619.0
SVE- 80	6777.6	5375.7	Dual-Phase	flush	6	639.94	20.71	15	619.2
SVE- 81	6754.4	5419.4	ISVE only	flush	4	640.65	11.02	5	629.6
SVE- 82	6751.9	5398.2	Dual-Phase	flush	6	639.09	20.57	15	618.5
SVE- 83	6731.6	5465.9	ISVE only	stick-up	4	645.52	15.00	5	630.5
SVE- 84	6694.4	5452.0	Dual-Phase	flush	6	638.76	20.88	15	617.9
SVE- 85	6709.7	5512.4	ISVE only	stick-up	4	645.54	15.00	5	630.5
SVE- 86	6670.0	5508.4	Dual-Phase	flush	6	639.36	20.65	15	618.7
SVE- 87	6678.3	5540.6	Dual-Phase	flush	6	639.62	20.89	15	618.7
SVE- 88	6826.1	5446.1	ISVE only	flush	4	643.03	11.17	5	631.9
AS- 1	6993.8	5475.7	Air-Sparge Well	flush	1	641.04	20.00	2	621.0
AS- 2	6938.6	5486.9	Air-Sparge Well	flush	1	641.91	20.00	2	621.9
AS- 3	6844.4	5459.5	Air-Sparge Well	flush	1	642.82	20.00	2	622.8
AS- 4	6836.3	5513.1	Air-Sparge Well	flush	1	641.75	20.00	2	621.8
AS- 5	6798.7	5549.1	Air-Sparge Well	flush	1	641.93	20.00	2	621.9
AS- 6	6890.2	5473.1	Air-Sparge Well	flush	1	642.50	20.00	2	622.5

**Notes:**

NA = Not available

in = inches

ft = feet

ft amsl = feet above mean sea level

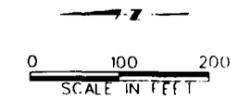
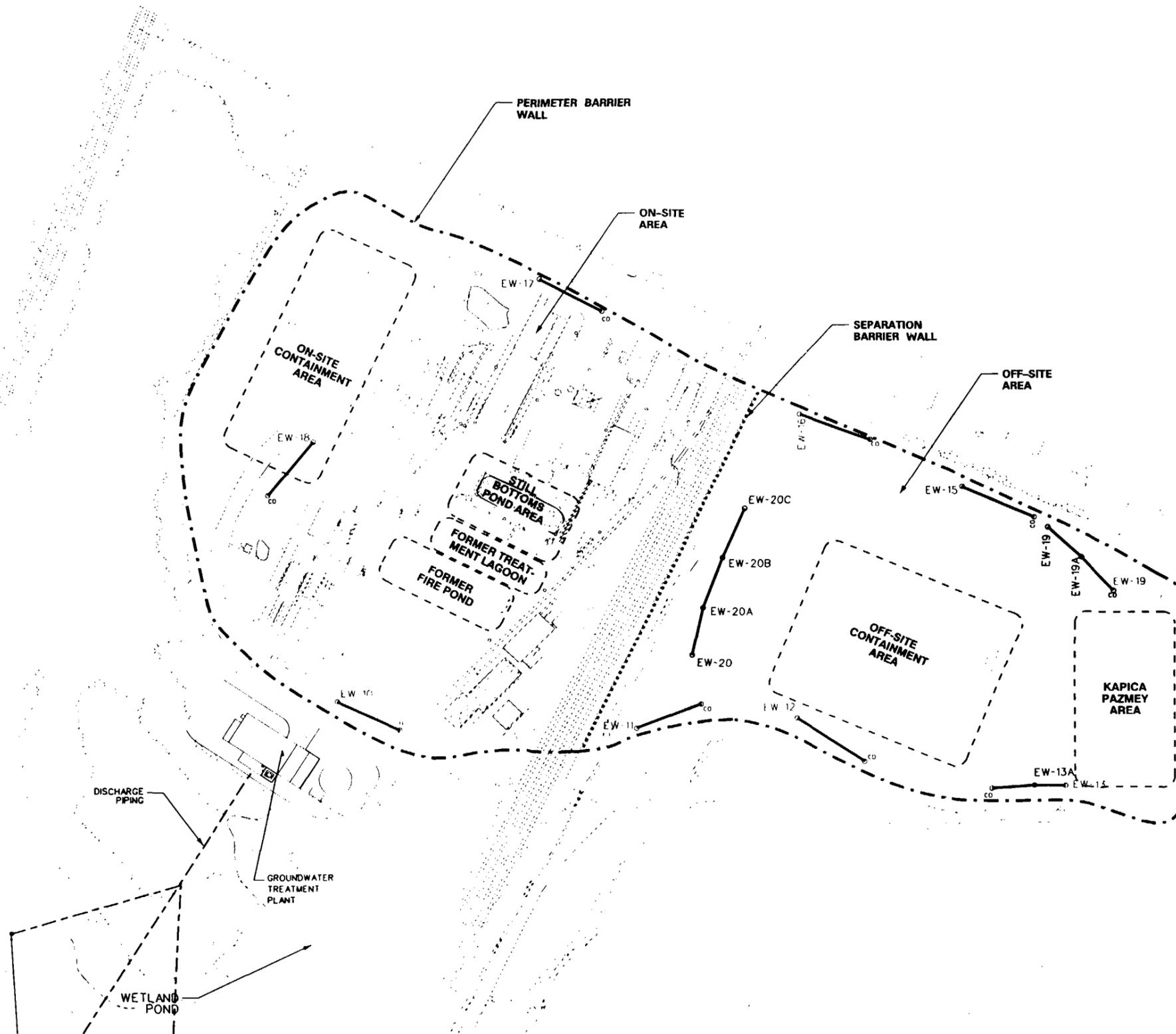
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## Figures

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Plot Date: 14-JUN-2004

File: J:\209\0601 ACS\0114 ISVE SBPA\Drawings\SITE MAP.dgn



REV	DATE	BY	DESCRIPTION

SCALE	DESIGNED <u>RAA</u>
AS SHOWN	DRAWN <u>MM</u>
	CHECKED <u>RAA</u>

SUBMITTED BY	
ROBERT A. ADAMS (PROJECT MANAGER)	LICENSE NO. _____ DATE _____
PETER VAGT (COMPANY OFFICER)	LICENSE NO. _____ DATE _____



ACS RD/RA GROUP  
 AMERICAN CHEMICAL SERVICE SUPERFUND SITE  
 GRIFFITH, INDIANA

STILL BOTTOM POND AREA ISVE SYSTEM CCR  
 SITE MAP

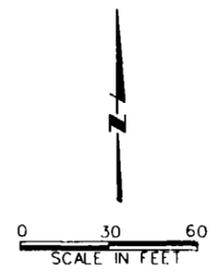
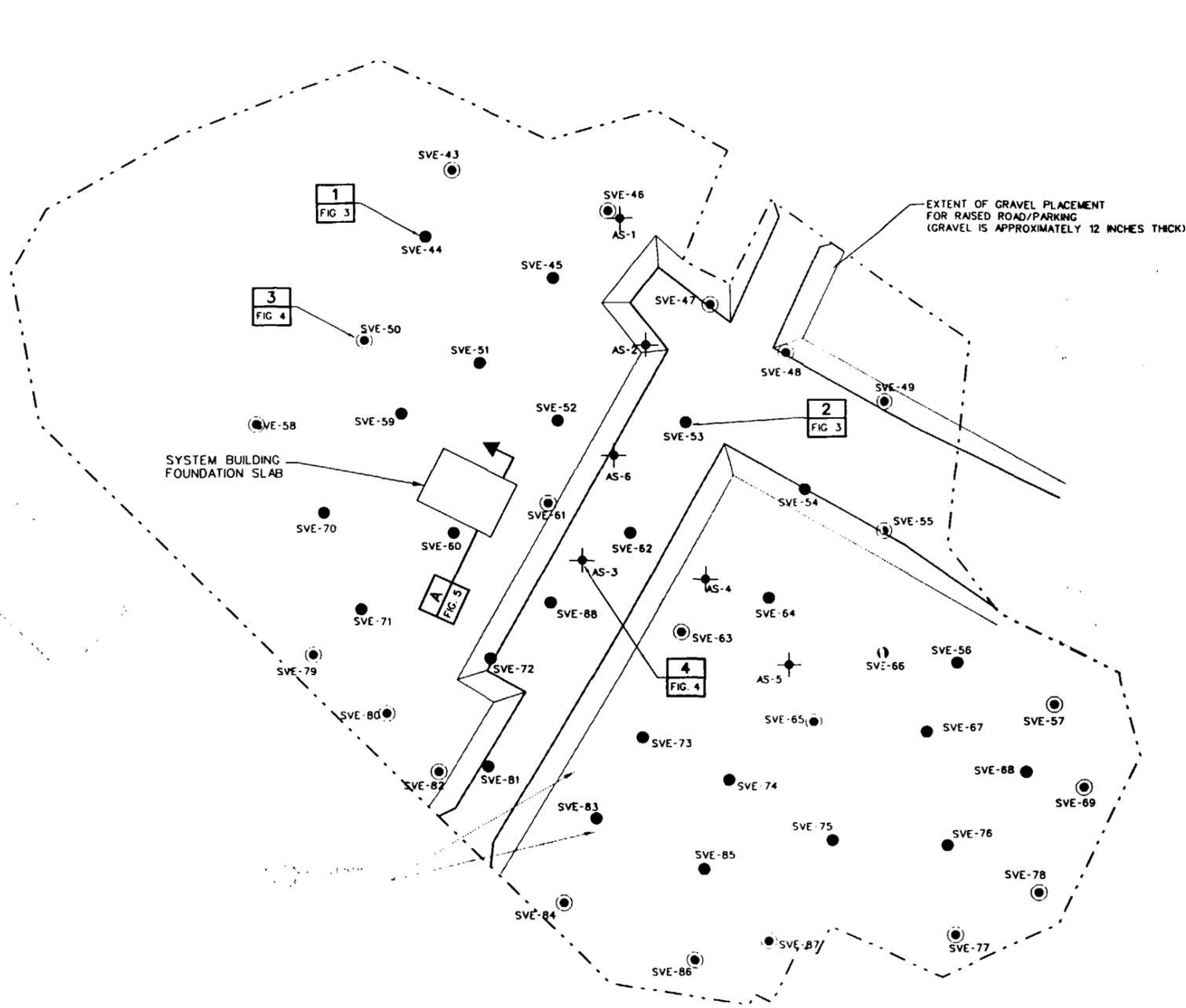
FIGURE  
 1

15-JUN-2004

Plot Date:

J:\209\0601 ACS\014 ISVE SPPAN Drawings\ISVE WELL LOCATIONS.dgn

File



**LEGEND:**

- SVE-54 ● ISVE WELL LOCATION
- SVE-55 ⊙ DUAL PHASE WELL LOCATION
- AS-1 ✦ AIR SPARGE POINT
- - - - - EXTENT OF COVER SYSTEM

**NOTE:**

THE SURVEY COORDINATES OF THE ISVE WELLS, DPE WELLS, AND AIR SPARGE POINTS ARE INCLUDED IN TABLE 1 OF THIS REPORT.

REV	DATE	BY	DESCRIPTION

SCALE	AS SHOWN
WARNING IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE	

DESIGNED	CAD
DRAWN	MM
CHECKED	RAA

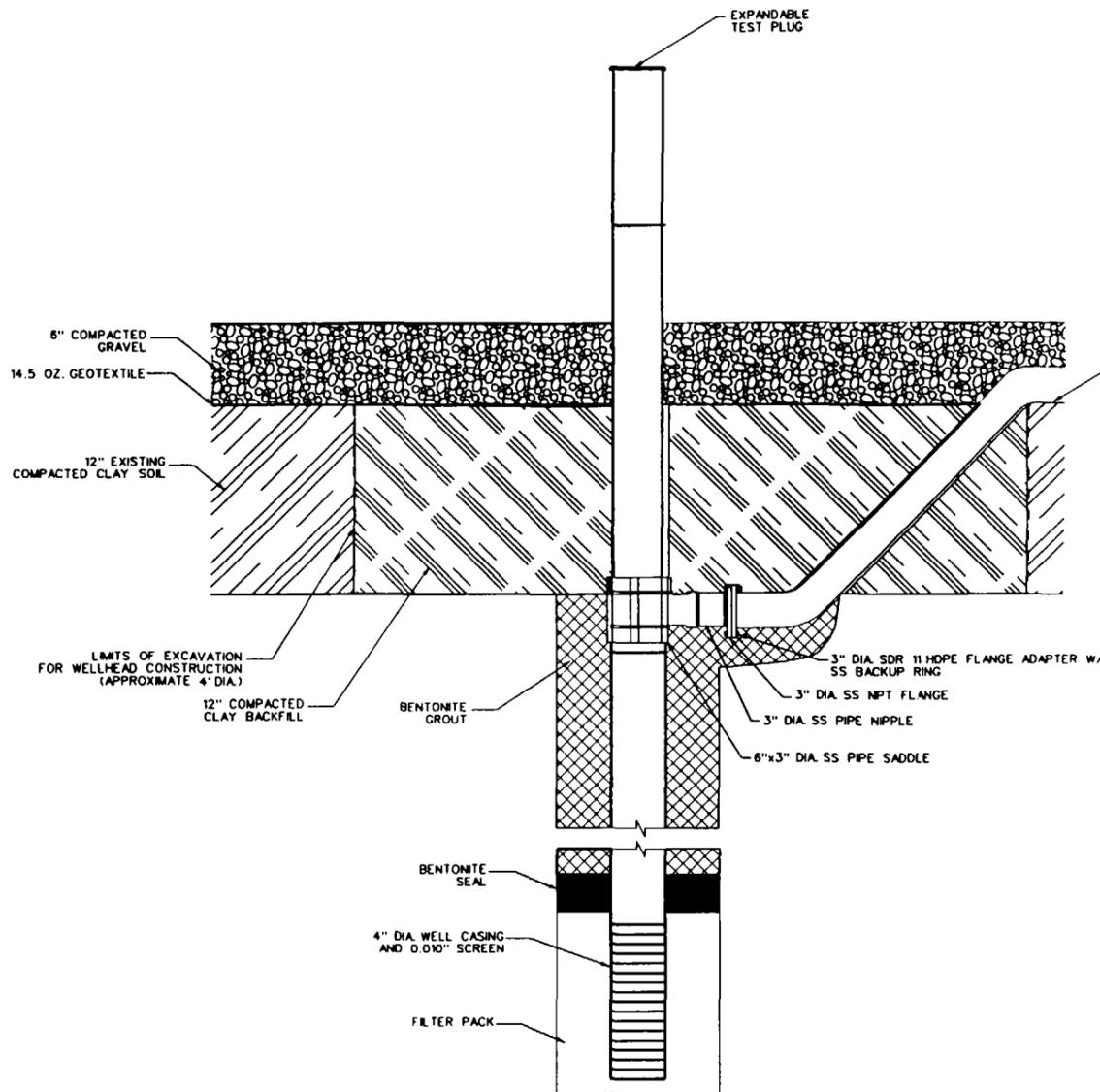
SUBMITTED BY			
ROBERT A. ADAMS	LICENSE NO.	DATE	
(PROJECT MANAGER)			
PETER VAGT	LICENSE NO.	DATE	
(COMPANY OFFICER)			



ACS RD/RA GROUP  
 AMERICAN CHEMICAL SERVICE SUPERFUND SITE  
 GRIFFITH, INDIANA

STILL BOTTOMS POND AREA ISVE SYSTEM CCR  
 ISVE WELL LOCATIONS  
 (INCLUDING DUAL PHASE EXTRACTION  
 WELLS AND AIR SPARGE WELLS)

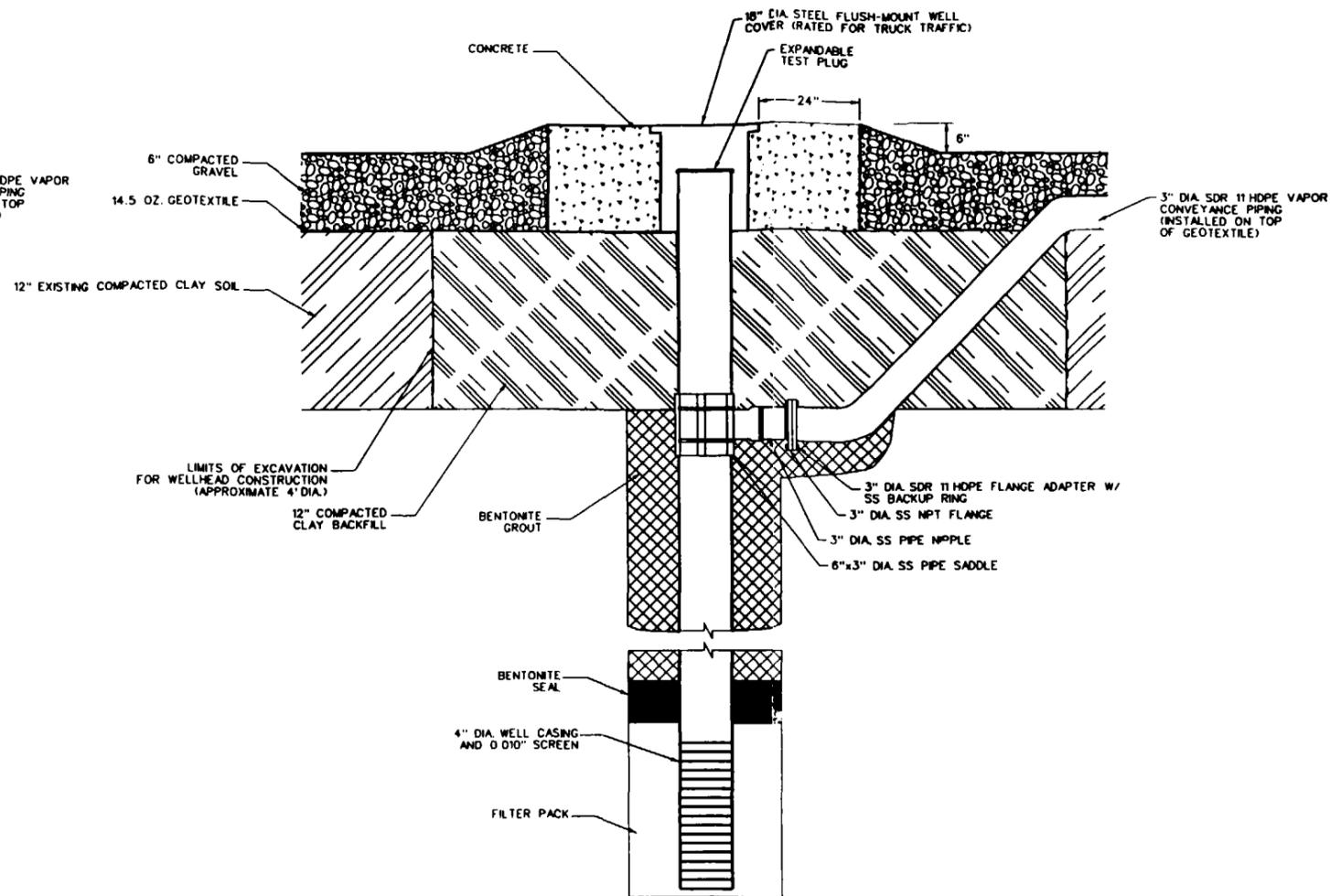
FIGURE  
 2



SOIL VAPOR EXTRACTION WELL (STICKUP)  
FINAL CONSTRUCTION

NOT TO SCALE

1  
FIG. 2



SOIL VAPOR EXTRACTION WELL (FLUSH-MOUNT)  
FINAL CONSTRUCTION

NOT TO SCALE

2  
FIG. 2

NOTE: SURVEY COORDINATES, WELL DEPTHS, AND SCREEN LENGTHS ARE INCLUDED IN TABLE 1 OF THIS REPORT.

P: 21 Date: 14 July 2004

209:260:ACE:014 S.E. SBPA:03w:13:26:0:3:2:23P

REV	DATE	BY	DESCRIPTION

SCALE	NONE
WARNING	IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED	CAD
DRAWN	MM
CHECKED	RAA

SUBMITTED BY	ROBERT A. ADAMS (PROJECT MANAGER)	LICENSE NO.	DATE
	PETER VAGT (COMPANY OFFICER)	LICENSE NO.	DATE



ACS RD/RA GROUP  
AMERICAN CHEMICAL SERVICE SUPERFUND SITE  
GRIFFITH, INDIANA

STILL BOTTOMS POND AREA ISVE SYSTEM CCR  
DETAILS - ISVE WELLS

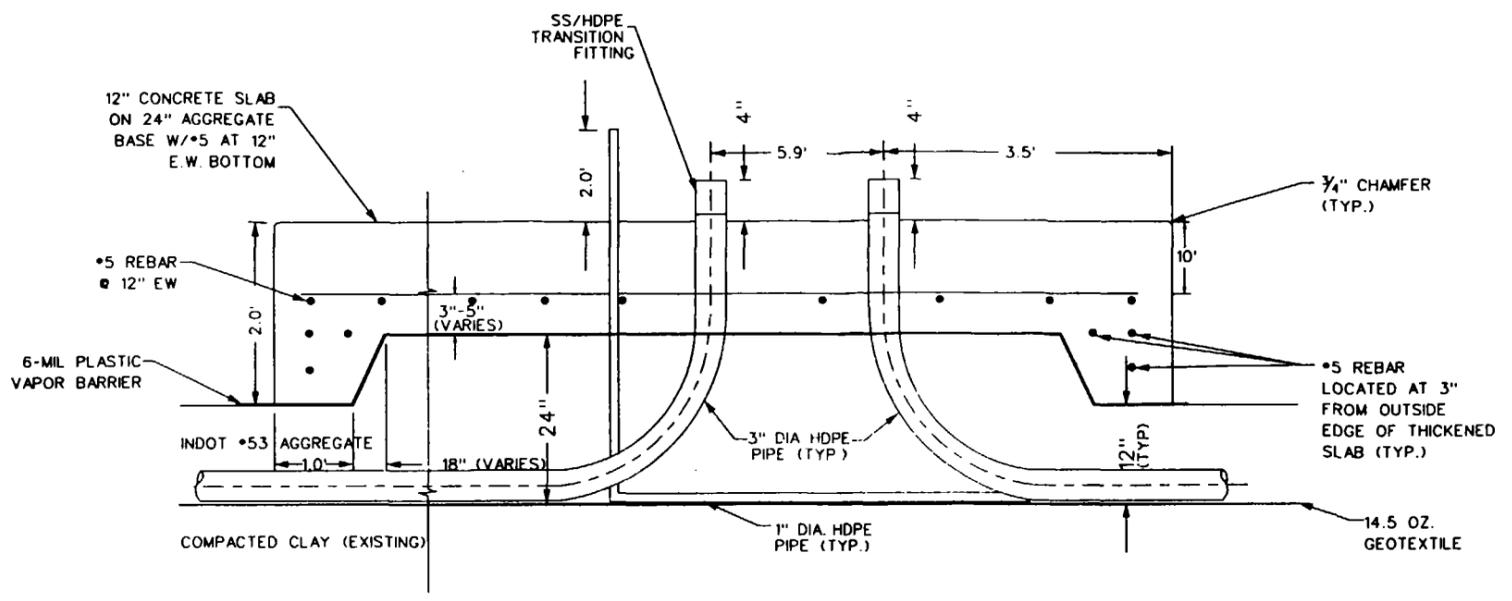
FIGURE  
3



14-JUN-2004

Plot Date:

J:\209\0601 ACS\0114 ISVE SBPA\Drawings\Blower Shed Foundation.dgn



CROSS-SECTION OF SYSTEM BUILDING FOUNDATION  
NOT TO SCALE

A
FIG. 2
FIG. 9

REV	DATE	BY	DESCRIPTION

SCALE  
NOT TO SCALE

WARNING  
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED CAD  
DRAWN MM  
CHECKED RAA

SUBMITTED BY  
ROBERT A. ADAMS  
(PROJECT MANAGER'S NAME) LICENSE NO. DATE  
PETER VAGT  
(COMPANY OFFICER'S NAME) LICENSE NO. DATE



ACS RD/RA GROUP  
AMERICAN CHEMICAL SERVICE SUPERFUND SITE  
GRIFFITH, INDIANA

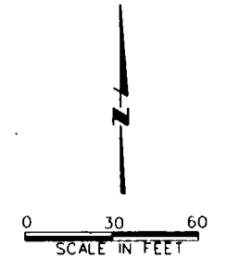
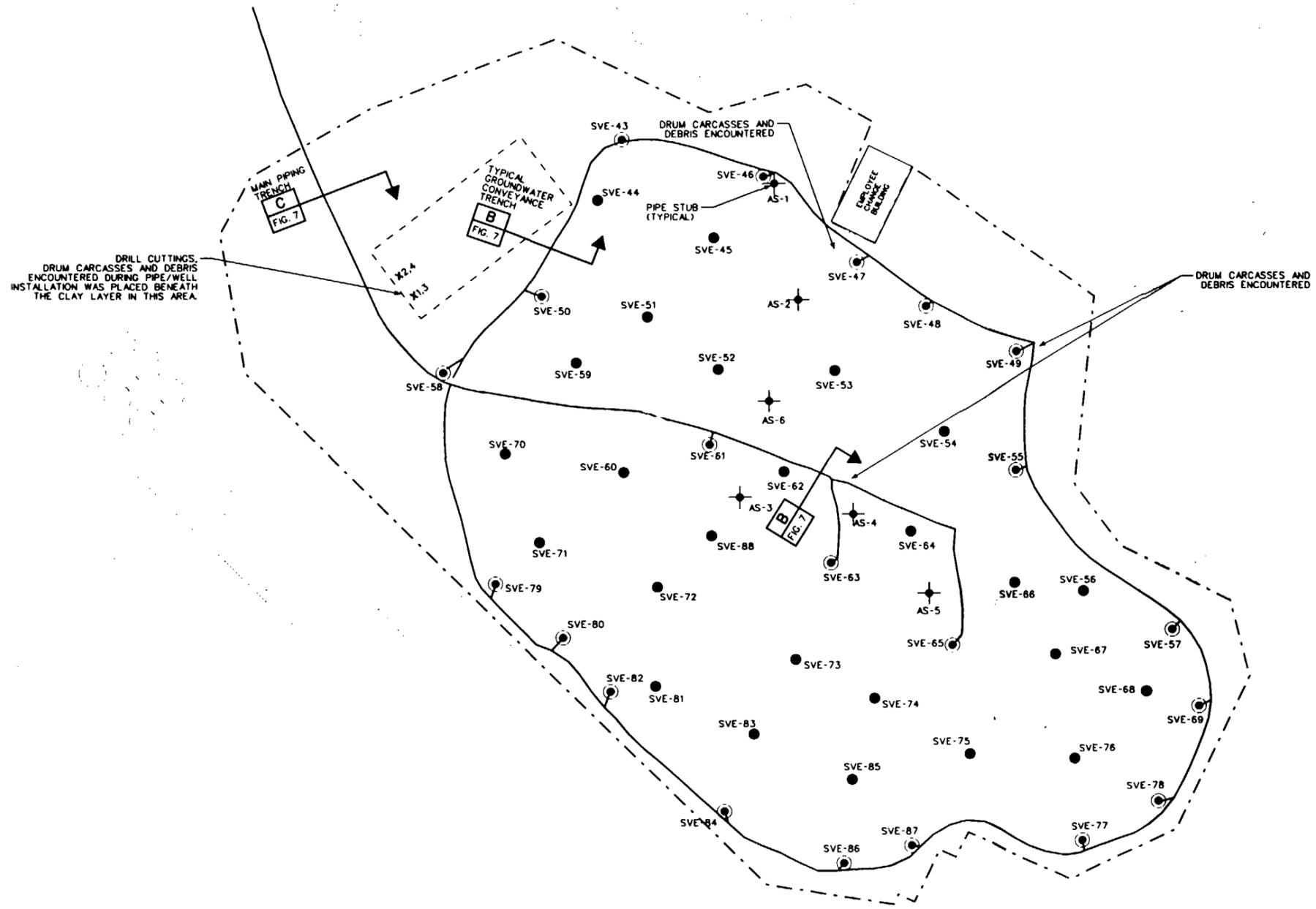
STILL BOTTOM POND AREA ISVE SYSTEM CCR  
SYSTEM BUILDING FOUNDATION

FIGURE  
5

14-JUN-2004

Plot Date:

J:\2004\0601 ACS\0114 ISVE SBPA\Drawings\GROUNDWATER CONVEYANCE PIPING LAYOUT.dgn



- LEGEND:**
- - - - - INTERIM COVER BOUNDARY
  - GROUNDWATER CONVEYANCE PIPE
  - GROUNDWATER CONVEYANCE PIPE STUB
  - SVE-54 ● ISVE WELL LOCATION
  - SVE-55 ⊙ DUAL PHASE WELL LOCATION
  - AS-L ✦ AIR SPARGE POINT
  - X1.3 ○ LOCATION OF FIELD DENSITY TEST

REV	DATE	BY	DESCRIPTION

SCALE AS SHOWN

WARNING  
0 1/2 1  
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED CAD  
DRAWN MM  
CHECKED RAA

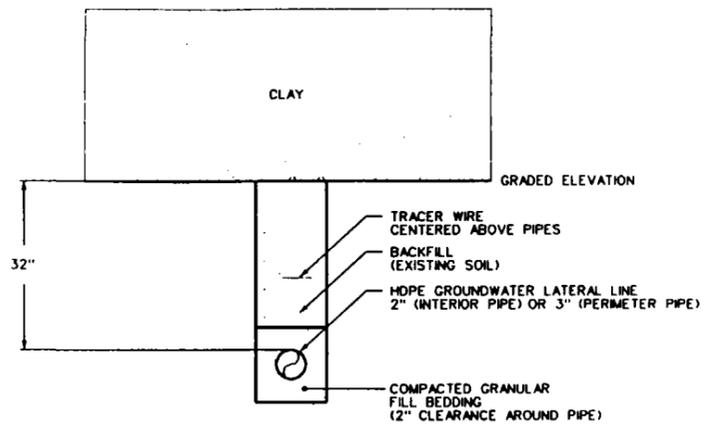
SUBMITTED BY  
ROBERT A. ADAMS  
(PROJECT MANAGER)  
LICENSE NO. DATE  
PETER VAGT  
(COMPANY OFFICER)  
LICENSE NO. DATE



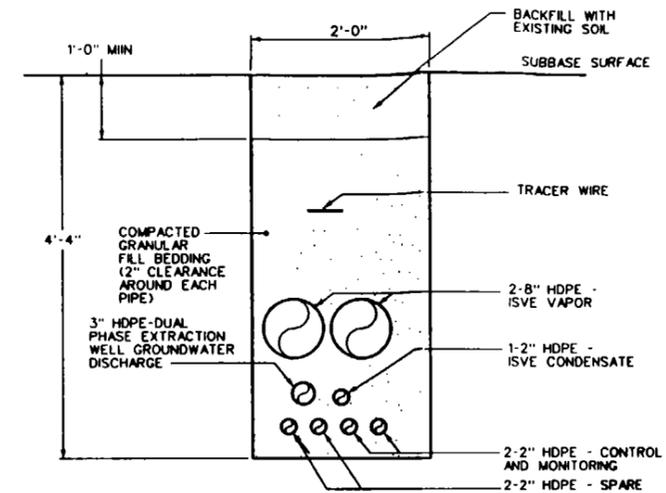
ACS RD/RA GROUP  
AMERICAN CHEMICAL SERVICE SUPERFUND SITE  
GRIFFITH, INDIANA

STILL BOTTOMS POND AREA ISVE SYSTEM CCR  
PRIMARY CONVEYANCE PIPING LAYOUT

FIGURE 6



TYPICAL GROUNDWATER CONVEYANCE TRENCH **B**  
NOT TO SCALE **FIG. 6**



MAIN PIPING TRENCH **C**  
NOT TO SCALE **FIG. 6**

Plot Date 15-JUN-2004

File: \\209\2601\ACS\0:14\_15-4E\_SBPFA\Crowings\Details 1.dgn

REV	DATE	BY	DESCRIPTION

SCALE	NONE
WARNING	IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED	CAD
DRAWN	MM
CHECKED	

SUBMITTED BY			
ROBERT A. ADAMS	(PROJECT MANAGER)	LICENSE NO.	DATE
PETER J. VAGT	(COMPANY OFFICER)	LICENSE NO.	DATE



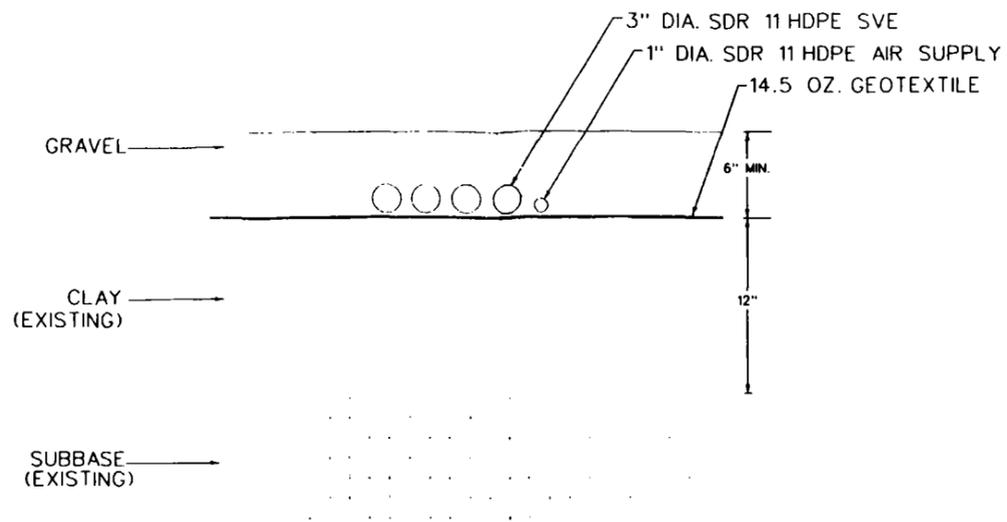
ACS RD/RA GROUP  
AMERICAN CHEMICAL SERVICE SUPERFUND SITE  
GRIFFITH, INDIANA

STILL BOTTOMS POND AREA ISVE SYSTEM CCR  
DETAILS - PRIMARY CONVEYANCE PIPING

FIGURE  
7

Plot Date 15-JUN-2004

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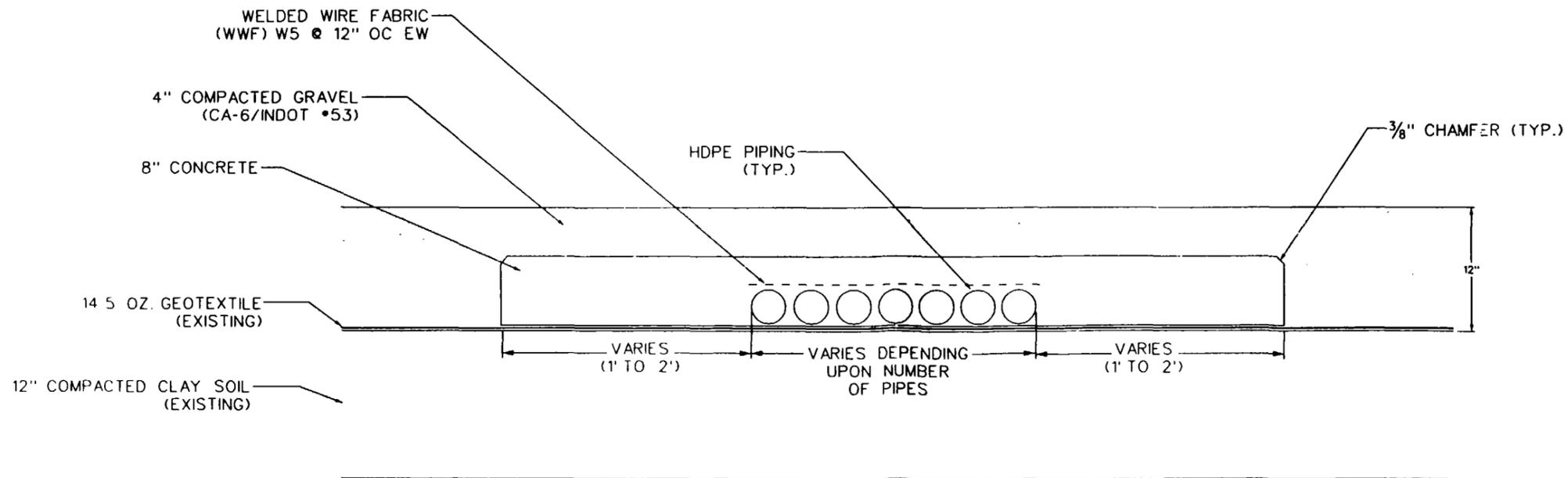


NOTE: EACH PIPE IS INDIVIDUALLY WRAPPED ALONG ITS LENGTH WITH 14.5 OZ. GEOTEXTILE FOR PROTECTION

**TYPICAL PIPING RUN**

NOT TO SCALE

**D**  
FIG. 9



**CONCRETE PROTECTIVE COVER (TYPICAL)**

NOT TO SCALE

**E**  
FIG. 9

REV	DATE	BY	DESCRIPTION

SCALE: NONE  
 WARNING: IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED: CAD  
 DRAWN: MM  
 CHECKED: RAA

SUBMITTED BY: ROBERT A. ADAMS (PROJECT MANAGER)  
 LICENSE NO: \_\_\_\_\_ DATE: \_\_\_\_\_  
 PETER VAGT (COMPANY OFFICER)  
 LICENSE NO: \_\_\_\_\_ DATE: \_\_\_\_\_



ACS RD/RA GROUP  
 AMERICAN CHEMICAL SERVICE SUPERFUND SITE  
 GRIFFITH, INDIANA

STILL BOTTOMS POND AREA ISVE SYSTEM CCR  
 DETAILS - ISVE CONVEYANCE PIPING

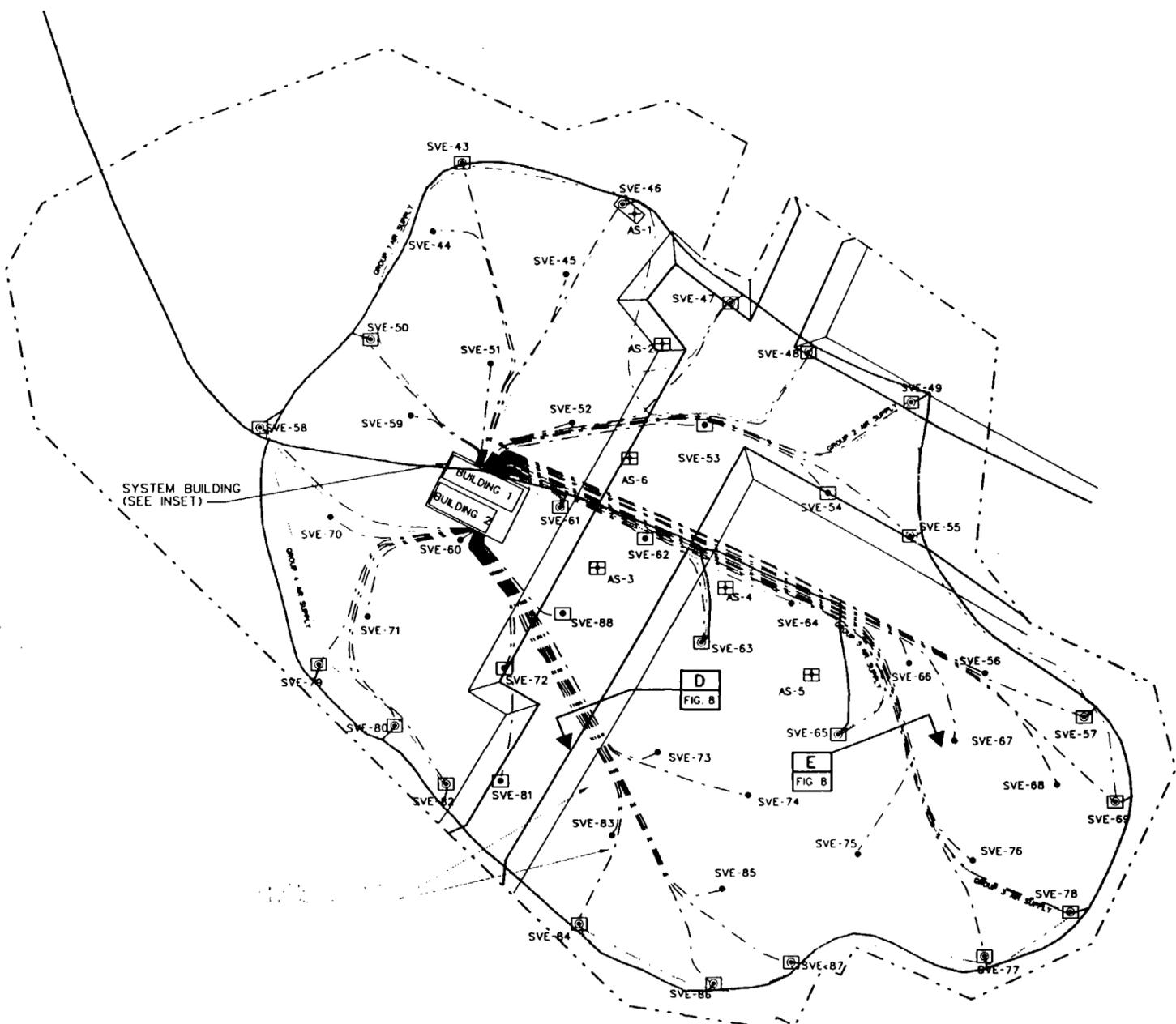
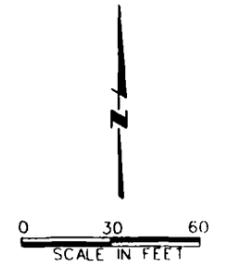
FIGURE 8

15 JUN 2004

Plot Date

J:\209\0601 ACS\0114 ISVE SBPA\Drawings\ISVE Conveyance Piping Layout\_2.dgn

File

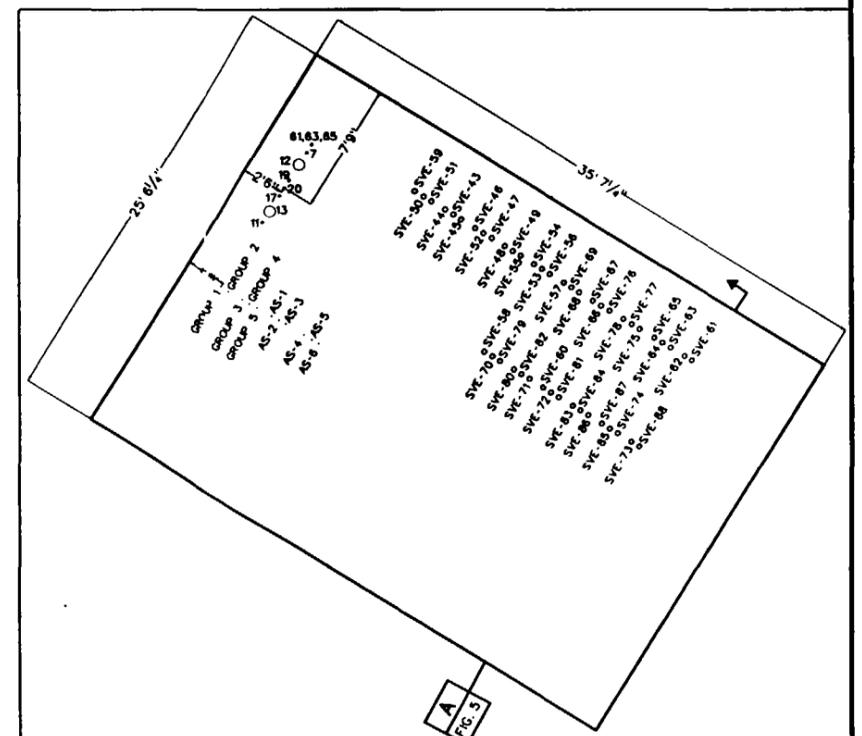


**LEGEND:**

- SVE-54 ● ISVE WELL LOCATION
- SVE-55 ◻ DUAL PHASE WELL LOCATION
- AS-1 + AIR SPARGE POINT
- ◻ FLUSH-MOUNT COVER
- DPE PUMP COMPRESSED AIR LINE (1" HDPE)
- AIR SPARGE PIPING (1" HDPE)
- ISVE CONVEYANCE PIPING (3" HDPE)
- GROUNDWATER CONVEYANCE PIPE
- GROUNDWATER CONVEYANCE PIPE STUB

**NOTES:**

1. PIPING LOCATIONS ARE APPROXIMATE
2. CONCRETE ENCASUREMENTS WERE PLACED AROUND ALL PIPING INSTALLED ABOVE THE CLAY LAYER THAT WAS LOCATED IN TRAFFIC AREAS



SYSTEM BUILDING INSET AND PIPING LAYOUT  
N.T.S.

NOTE: PIPES DESIGNATED AS "GROUP-" AND "AS-" ARE RUN OUTSIDE OF BUILDING AND ARE NOT PART OF THE ISVE HEADER SYSTEM.

REV	DATE	BY	DESCRIPTION

SCALE  
AS SHOWN

WARNING  
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED CAD  
DRAWN MM  
CHECKED RAA

SUBMITTED BY  
ROBERT A. ADAMS  
(PROJECT MANAGER)

PETER VAGT  
(COMPANY OFFICER)

LICENSE NO. DATE



ACS RD/RA GROUP  
AMERICAN CHEMICAL SERVICE SUPERFUND SITE  
GRIFFITH, INDIANA

STILL BOTTOMS POND AREA ISVE SYSTEM CCR  
ISVE CONVEYANCE PIPING LAYOUT

FIGURE  
9

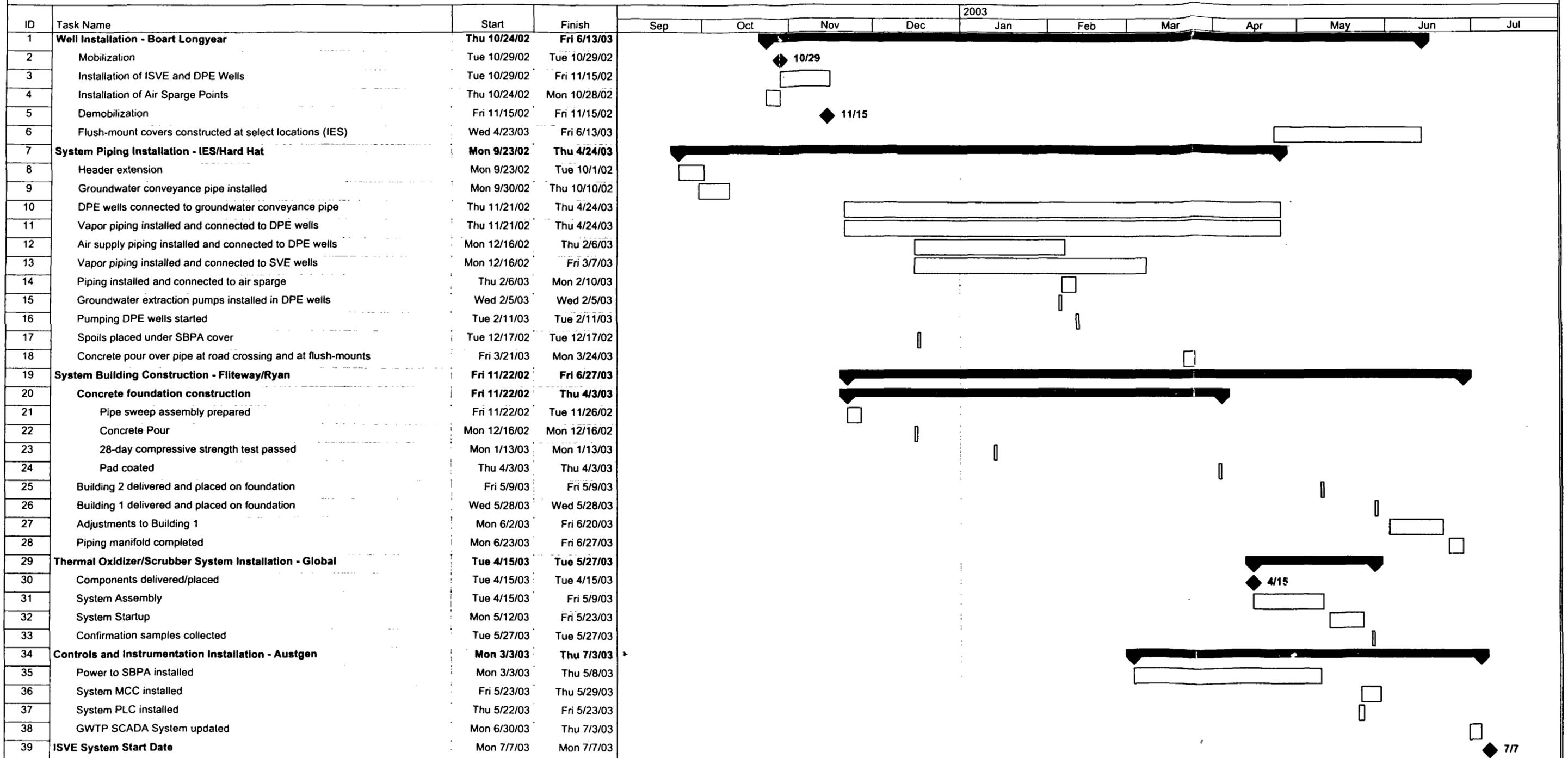
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## Appendix A

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**APPENDIX A**  
**SEQUENCE OF CONSTRUCTION ACTIVITIES**

SBPA In-Situ Vapor Extraction System  
Sequence of Construction Activities  
ACS NPL Site  
Griffith, Indiana



Project: SBPA ISVE Sequence  
Date: Mon 1/5/04

Task		Progress		Summary		External Tasks		Deadline	
Split		Milestone		Project Summary		External Milestone			

**APPENDIX B**  
**PHOTOGRAPH LOG**

**Photograph Log**  
**Still Bottoms Pond Area ISVE System**  
**American Chemical Service - NPL Site**  
**Griffith, Indiana**



1. September 2002 (Looking Southeast): Installation of the groundwater conveyance piping.



2. September 2002 (Looking East): Installation of the groundwater conveyance piping from the GWTP to the future location of the system buildings.

**Photograph Log**  
**Still Bottoms Pond Area ISVE System**  
**American Chemical Service - NPL Site**  
**Griffith, Indiana**



3. September 2002: Debris and drum carcasses encountered during the groundwater conveyance pipe installation.



4. September 2002 (Looking Northeast): Fusing of groundwater conveyance piping.

**Photograph Log**  
**Still Bottoms Pond Area ISVE System**  
**American Chemical Service - NPL Site**  
**Griffith, Indiana**



5. October 2002 (Looking East): Drilling activities during well installation.



6. October 2002 (Looking West): Exclusion zones were established around each drilling and well installation location.

**Photograph Log**  
**Still Bottoms Pond Area ISVE System**  
**American Chemical Service - NPL Site**  
**Griffith, Indiana**



7. October 2002 (Looking South): Routine air monitoring was performed around each drilling and well installation activity area.



8. October 2002 (Looking West): Soil cuttings from the drilling and well installation activities were placed in a rolloff box and covered with plastic. An exclusion zone was established and air monitoring was routinely conducted.

**Photograph Log**  
**Still Bottoms Pond Area ISVE System**  
**American Chemical Service - NPL Site**  
**Griffith, Indiana**



9. October 2002 (Looking Northeast): Installation of an ISVE well.



10. February 2003 (Looking North): Excavating around a well in order to install the saddle and vapor conveyance piping.

**Photograph Log**  
**Still Bottoms Pond Area ISVE System**  
**American Chemical Service - NPL Site**  
**Griffith, Indiana**



11. February 2003: Tapping an ISVE well in order to install vapor conveyance piping and the pipe saddle.



12. February 2003: Connection of compressed air supply piping to a DPE well.

**Photograph Log**  
**Still Bottoms Pond Area ISVE System**  
**American Chemical Service - NPL Site**  
**Griffith, Indiana**



13. February 2003: Completed connection of a vapor conveyance piping to an DPE well.



14. March 2003 (Looking North): Vapor conveyance and air supply piping laid from system building location to the various wells. The piping has been wrapped in geotextile for protection.

**Photograph Log**  
**Still Bottoms Pond Area ISVE System**  
**American Chemical Service - NPL Site**  
**Griffith, Indiana**



15. April 2003 (Looking Northeast): Preparation of subbase for the system building foundation slab.



16. April 2003 (Looking Southwest): Pouring of the concrete for the system building foundation slab.

**Photograph Log**  
**Still Bottoms Pond Area ISVE System**  
**American Chemical Service - NPL Site**  
**Griffith, Indiana**



17. April 2003 (Looking South): Installation of the thermal oxidizer unit.



18. April 2003: Scrubber unit installed.

**Photograph Log**  
**Still Bottoms Pond Area ISVE System**  
**American Chemical Service - NPL Site**  
**Griffith, Indiana**



19. May 2003 (Looking West): ISVE well with stickup surface completion.



20. May 2003 (Looking Northeast): ISVE well with flush-mount surface completion.

**Photograph Log**  
**Still Bottoms Pond Area ISVE System**  
**American Chemical Service - NPL Site**  
**Griffith, Indiana**



21. May 2003 (Looking Southwest): Placement of Building 2.



22. July 2003: Interior of Building 1.

**APPENDIX C**

**BORING LOGS AND WELL CONSTRUCTION DIAGRAMS**

## **Air Sparge Points**

Facility/Project Name <u>ACS</u>	Boring No. <u>AS-1</u>
Location <u>SBPA</u>	Project No. _____

Drilling Company <u>Bart Longyear</u> Driller's Name <u>Alan</u> Driller's Helper <u>Kevin</u> Drill Method <u>Greaseprobe PIT</u>	State Plane _____ N _____ E Local Grid Location _____ ft <input type="checkbox"/> N _____ ft <input type="checkbox"/> E _____ ft <input type="checkbox"/> S _____ ft <input type="checkbox"/> W _____ 1/4 of _____ 1/4 of Section _____ T _____ N,R _____ EW Borehole Diameter _____ at Screen _____
Water Level _____	Sample Hammer Torque _____

Sample No.	Moisture	Blows on Sampler		Sample Recovery	Depth	Logger <u>C. Smith</u>	Editor _____	Fenestrometer (Tons/sq. ft.)	PID	Description	Remarks
		0/6	6/12			Start Date <u>10/24/02 12:15</u>	End Date <u>12:35</u>				
<b>VISUAL CLASSIFICATION</b>											
1				100%	0'-4	0-1.5 clay cap					
						1.5-4 sand gray-tan, fine to med sand from machine angular gravel (SP) some silt fill?			60		
2				70%	4'-8	4-8 4'-6" soft swell layer @ 5'			535		
						6'-8' dk gray to black stained silt (MC) some sand strong odor, moist.					
3				100	8'-12'	8-10' SW gray stained, blue @ 9'			722		
					10	10-12 sandy silt tan-gray w/ gravel minimal staining, less PID #'s 2" med gravel at 12'					
4					12'-16	12-14 gravelly sand (SW), fine gravel to coarse sand w/ some med. size sand. gray color, wet, no stain.			100		
					15	14-15.5 gray sand (SW) fine gravel very slight staining near 15.5' (w/ to 2")					
					20	15.5-16 gray silty clay (MC) soft, plastic, no gravel, dry			19		
					25	FOB @ 16' down - want to push through clay layer.					
					30						
					35						

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name AS-1  
 Driller/Lic.# Alan Thomas / IN #1807  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

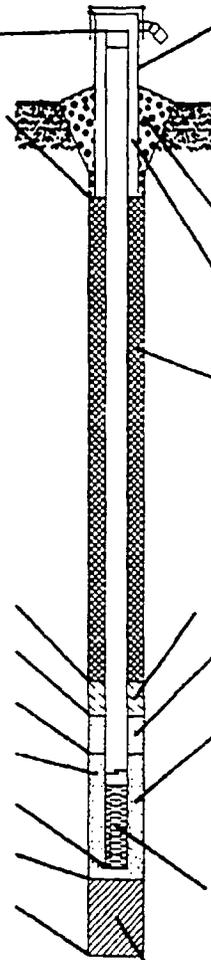
Type of Well:  
 In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Static Water Level 10 ft.

Date 10/24/2002

Drilling Method: DPT (Geoprobe®)  
 1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 1.0 ft.
- B. Diameter of Well Casing 1.0 in.
- C. Borehole Diameter 2.25 in.
- D. Surface Seal Bottom 1.5 ft.
- E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel



- 2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post  No  Yes 3" 4"
- 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_

5. Annular Space Seal: Granular Bentonite  
 Type: \_\_\_\_\_  
 Amount: \_\_\_\_\_ pounds

Lithology	From	To
Gray clay	0	1.5
Gray/brown sandy soil	1.5	8
Gray sand, medium	8	16
Gray clay, soft	16	17
Not sampled	17+	

How Installed:  
 Gravity  
 Tremie Pumped

- F. Bentonite Seal Top 7.0 ft.
- G. Fine Sand Top N/A ft.
- H. Filter Pack Top 9.0 ft.
- I. Screen Joint Top 18.0 ft.
- J. Well Bottom 20.0 ft.
- K. Filter Pack Bottom 20.0 ft.
- L. Borehole Bottom 20.0 ft.

- 6. Bentonite Seal:  Granules  
 Pellets
- 7. Type of Fine Sand: None
- 8. Type of Filter Pack: Natural

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 2.0 ft.

10. Backfill Material: (Below filter pack)  
None

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

Facility/Project Name <u>ACS</u> Location <u>Griffith, IN</u>	Boring No. <u>AS-2</u> Project No. _____
Drilling Company <u>Bart Long year</u> Driller's Name <u>Alan Thomas</u> Driller's Helper <u>Kevin O'Brien</u> Drill Method <u>Geoprobe DPT</u>	State Plane _____ N. _____ E. _____ <input type="checkbox"/> N <input type="checkbox"/> E Local Grid Location _____ ft <input type="checkbox"/> S _____ ft <input type="checkbox"/> V _____ 1/4 of _____ 1/4 of Section _____, T _____ N,R _____ EW Borehole Diameter _____ at Screen _____
Water Level <u>N/A</u> Sample Hammer Torque _____	Surface Elevation _____

Sample No.	Moisture	Blows on Sampler		Sample Recovery	Depth	Logger	Editor	Penetrometer (Tons/sq. ft.)	PID	Description	Remarks	
		0/6	6/12			C. Smith						
						<b>VISUAL CLASSIFICATION</b>						
						Start Date	End Date					
						<u>10/27/02</u>	<u>1250</u>	<u>1330</u>	<u>1430</u>			
1				100%	0'-4'	0-1.5' Hard tan clay (CL) (Clay cap)						
						1.5'-4' Brown sand (SP) grading to black-stained at 3'					1120	
2				50	5	4'-8'	4'-7' Gray sand (SW), fine grained dk-gray to black stains at 6'-7'					1050
						7'-8' (SAA), tan to brown color less staining, fine to med. grained.						
3				25	10	8'-12'	poor recovery due to high water content. dk. brown silty sand, sheen on top water + soils.					1100
4				100%	15	12'-16'	12'-15' dk. brown sandy silt (ML) w/ little coarse sand + gravel reddish color - in parts wood fragments 12'-13' wet, yellow + black banding in silty clay @ 15' - (bottom of SBPA?) bands are 1mm thick.					988
					20	15'-16' Gray-yellow sand (SW) some silt, trace gravel/shells.						
5	2' only			100%	25	16'-18'	Tan gray sand (SW) fine to med. sand, no silt two 1" clay/silt lenses at 16' black stains at 17'					220
6				100%	30	18'-20'	gray-brown sand (SW), no clay encountered					420
					35	EOB @ 20' setting AS well screen 18'-20'						

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name AS-2  
 Driller/Lic.# Alan Thomas / IN #1807  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203  
 Date 10/24/2002

Type of Well:  
 In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Static Water Level  
10 ft.

Drilling Method: DPT (Geoprobe®)  
 1. Locking Cap?  Yes  No

A. Height of Well Casing above ground  
2.0 ft.

B. Diameter of Well Casing  
1.0 in.

C. Borehole Diameter  
2.25 in.

D. Surface Seal Bottom  
1.5 ft.

E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

Lithology	From	To
Gray clay	0	1.5
Gray/brown sandy soil	1.5	8
Gray sand, medium	8	20

F. Bentonite Seal Top 14.0 ft.

G. Fine Sand Top N/A ft.

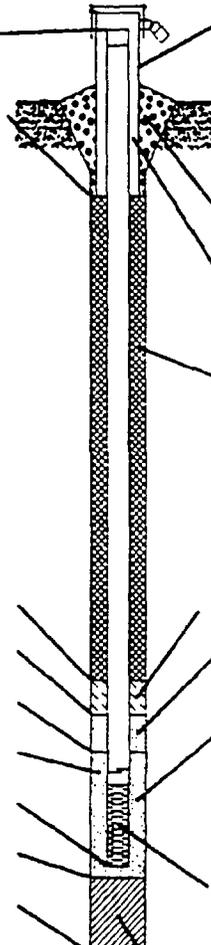
H. Filter Pack Top 16.0 ft.

I. Screen Joint Top 18.0 ft.

J. Well Bottom 20.0 ft.

K. Filter Pack Bottom 20.0 ft.

L. Borehole Bottom 20.0 ft.



2. Protective Cover: a. Inside diam.      in.  
 b. Length      ft.  
 c. Material Steel  
 None  
 d. Bumper Post No qty       
3" 4"

3. Surface Seal: Bentonite  
Concrete  
 Other Clay

Material between Casing and Protop:  
 None  
Other

5. Annular Space Seal: Granular Bentonite  
 Type:       
 Amount:      pounds

How Installed:  
 Gravity  
 Tremie Pumped

6. Bentonite Seal:  Granules  
 Pellets

7. Type of Fine Sand: None

8. Type of Filter Pack: Natural

9. Screen Material: Sch. 40 Stainless Steel  
 Type: Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 2.0 ft.

10. Backfill Material: (Below filter pack)  
None

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey

Signature: William C. Stuckey

All depths are below ground surface (top of clay)  
 unless otherwise noted.



Facility/Project Name _____		Boring No. <u>AS 3</u>	
Location _____		Project No. _____	
Drilling Company _____		State Plane _____ N, _____ E	
Driller's Name <u>Alan</u>		<input type="checkbox"/> N <input type="checkbox"/> E	
Driller's Helper <u>Kevin, Dave</u>		Local Grid Location _____ ft <input type="checkbox"/> S _____ ft <input type="checkbox"/> W	
Drill Method _____		_____ 1/4 of _____ 1/4 of Section _____, T _____ N,R _____ EW	
Water Level _____		Surface Elevation _____	
Sample Hammer Torque _____		Borehole Diameter _____ at Screen _____	

Sample No.	Moisture	Blows on Sampler		Sample Recovery	Depth	Logger <u>C. Smith</u>	Editor _____	Penetrometer (Tons/sq. ft.)	PID	Description	Remarks
		0/6	6/12			Start Date <u>10/26 930</u>	End Date <u>1015</u>				
1				100%	0-4	<b>VISUAL CLASSIFICATION</b>					
						0-1.5 clay (cl) cap					
						1.5-4 sand (sp) fine grained, light brown color, trace gravel.					
2				75%	4'-8"				140		
						met @ 6'					
						mix of sand, silt - clay, layered					
						clay is soft - red, green, black colored, soft					
						sand, is dk brown, trace gravel.					
3				100%	8'-12"				400		
						SAA mix, free product/shell on soil, silt, clay, sand					
4				50%	12'-16"				1110		
						have product					
						sand, <del>product</del> sand/silt mixture, little clay					
						soft - black stained					
						15.5-16' light gray brown sand (fin) w/ silt, fine med. grain, wet.					
						less stained					
5				100	16'-20'				1020		} straight?
						16'-16.8' SAA, black sand/clay/silt mix product stained (free product)					
						1.8'-20' sand (co) light brown to gray some staining @ 19'			33		
						1 cm thick silt seam at 17.5'					
						no gravel, trace coarse sand					
6				100%	20'-24'				225		
						20'-21' SAA gray sand old brick wet, grainy, dk gray silt					
						1 cm thick silt lenses @ 21'					
						dense, wet, not compacted					
						w/ clay					
						well set - 20'-18'					



# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name AS-3  
 Driller/Lic.# Alan Thomas / IN #1807  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

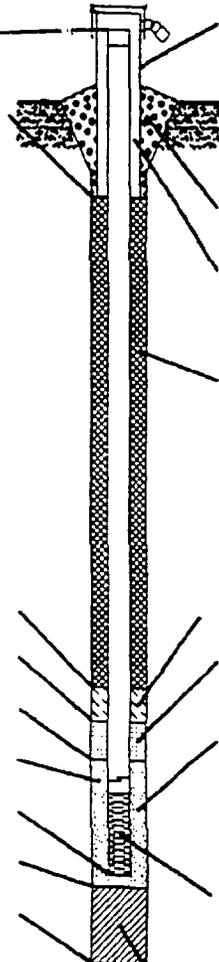
Type of Well: \_\_\_\_\_ Static Water Level 10 ft. Date 10/28/2002

- In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Drilling Method: DPT (Geoprobe®)

1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 2.0 ft.  
 B. Diameter of Well Casing 1.0 in.  
 C. Borehole Diameter 2.25 in.  
 D. Surface Seal Bottom 1.5 ft.  
 E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel



2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material \_\_\_\_\_ Steel  
 None  
 d. Bumper Post  No  3"  4"  
 3. Surface Seal: \_\_\_\_\_ Bentonite  
 \_\_\_\_\_ Concrete  
 Other Clay

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_  
 5. Annular Space Seal: Granular Bentonite  
 Type: \_\_\_\_\_  
 Amount: \_\_\_\_\_ pounds

Lithology	From	To
Gray clay	0	1.5
Brown, silty sand	1.5	24

- How Installed:  
 Gravity  
 Tremie Pumped  
 6. Bentonite Seal:  
 Granules  
 Pellets  
 7. Type of Fine Sand: None  
 8. Type of Filter Pack: Natural

- F. Bentonite Seal Top 8.0 ft.  
 G. Fine Sand Top N/A ft.  
 H. Filter Pack Top 10.0 ft.  
 I. Screen Joint Top 18.0 ft.  
 J. Well Bottom 20.0 ft.  
 K. Filter Pack Bottom 24.0 ft.  
 L. Borehole Bottom 24.0 ft.

9. Screen Material: Sch. 40 Stainless Steel  
 Type: \_\_\_\_\_ Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 2.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey

Signature: William C. Stuckey

All depths are below ground surface (top of clay)  
 unless otherwise noted.

Facility/Project Name _____ Location _____	Boring No. <u>AS-4</u> Project No. _____
Drilling Company <u>BLT</u> Driller's Name <u>Alan</u> Driller's Helper <u>Kevin</u> Drill Method _____	State Plane _____ N. _____ E. _____ <input type="checkbox"/> N <input type="checkbox"/> E <input type="checkbox"/> S <input type="checkbox"/> W Local Grid Location _____ ft _____ ft _____ 1/4 of _____ 1/4 of Section _____, T _____ N,R _____ EW Borehole Diameter _____ Surface Elevation _____ at Screen _____
Water Level _____ Sample Hammer Torque _____	

Sample No.	Moisture	Blows on Sampler		Sample Recovery	Depth	Logger <u>C. Smith</u> Start Date <u>12/28/06</u> 1310	Editor _____ End Date <u>1350</u>	Penetrometer (Tons/sq. ft.)	PID	Description	Remarks
		0/6	6/12								
				100%	0-4	<b>VISUAL CLASSIFICATION</b>					
					0-1.5'	Clay cell - 0%					Fill
					1.5-3'	gravelly sand fill (SW); brown					
					3-4'	fine sand (SP) black stain dry, loose					
2				100%	4-8	4-8'		1082			
						6.5" gray + black - stained					
						7-8" wet stained - brown to yellow-orange					
3				100%	8-12	8-12'		1511			
						light gray to yellow-orange fine sand (SP) no gravel, until 12' - trace sand med. dense - moist to wet at 12'					
4				100%	12-16	12-16'					
						SAP 12'-13.5' dk. staining at 13' (SP-SM) yellow at 12.5'					
						13.5'-13.6' - large gravel (subbase?)					
						13.6'-14' gray sand (SM) - occasionally coarse sand & gravel seams produce coarse in 14'					
5				100%	16-20	16-20'		405 55			
						SAP silty sand becomes very dense at 19'					
6				75	20-24	20-24'					
						SAP gray sand (SM) grading to gravelly + water (SW) at 22', trace to some clay 21-24' cont moist.					
						EUB 24' screen 20-18' cabin 24-20'					

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

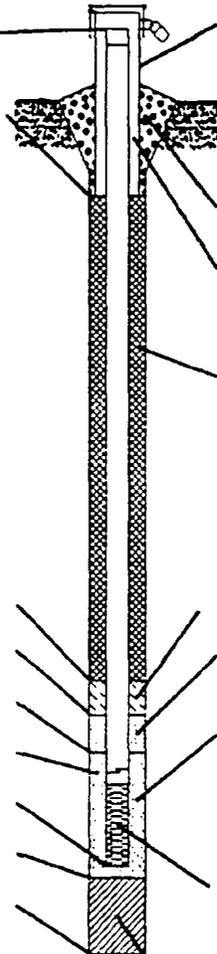
Well Name AS-4  
 Driller/Lic.# Alan Thomas / IN #1807  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 10/28/2002

- In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Drilling Method: DPT (Geoprobe®)  
 1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 2.0 ft.  
 B. Diameter of Well Casing 1.0 in.  
 C. Borehole Diameter 2.25 in.  
 D. Surface Seal Bottom 1.5 ft.  
 E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel



2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material  Steel  None  
 d. Bumper Post  No  3"  4" qty
3. Surface Seal:  Bentonite  Concrete  Other Clay

Material between Casing and Protop:  None  Other \_\_\_\_\_

5. Annular Space Seal: Granular Bentonite  
 Type: \_\_\_\_\_  
 Amount: \_\_\_\_\_ pounds

Lithology	From	To
Gray clay	0	1.5
Brown, silty sand	1.5	24

How Installed:  Gravity  Tremie Pumped

- F. Bentonite Seal Top 14.0 ft.  
 G. Fine Sand Top N/A ft.  
 H. Filter Pack Top 16.0 ft.  
 I. Screen Joint Top 18.0 ft.  
 J. Well Bottom 20.0 ft.  
 K. Filter Pack Bottom 24.0 ft.  
 L. Borehole Bottom 24.0 ft.

6. Bentonite Seal:  Granules  Pellets
7. Type of Fine Sand: None
8. Type of Filter Pack: Natural

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 2.0 ft.

10. Backfill Material: (Below filter pack) Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey

Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

Facility/Project Name _____		Boring No. <u>AS-5</u>
Location _____		Project No. _____
Drilling Company _____		State Plane _____ N, _____ E
Driller's Name _____		Local Grid Location _____ ft <input type="checkbox"/> N _____ ft <input type="checkbox"/> E
Driller's Helper _____		_____ 1/4 of _____ 1/4 of Section _____, T _____ N,R _____ EW
Drill Method _____		Surface Elevation _____ at Screen
Water Level _____		Borehole Diameter _____
Sample Hammer Torque _____		

Sample No.	Moisture	Blows on Sampler		Sample Recovery	Depth	Logger <u>C. Smith</u>	Editor _____	Penetrometer (Tons/sq. ft.)	PID	Description	Remarks
		0/6	6/12			Start Date <u>10/28/15</u>	End Date <u>14/8</u>				
<b>VISUAL CLASSIFICATION</b>											
1				100%	0'-4'	0'-1' clay cap			126		Fill 
						1'-3' sand-gravel fill					
						3'-4' sand (SP) - to lach stained					
2				100%	5	4'-8' sand (SP) w/ debris, med. trace gravel			942		
						1 1/2" gray to orange to light brown color					
						moist, loose					
3				80%	10	8'-12' sand (SMA) banding, w/ many caps + staining, trace gravel, moist.			940		
4				?	15	12'-16' 12'-15' sandy gravel (SW) looks like pea gravel, moist to wet, loose			340		
						15'-16' gray sand (SP-GM) fine-medium					
						no gravel, hard coarse sand					
5				?	20	16'-20' gray sand + gravelly sand (SW)			15		
						olive gray, moist/wet no					
6				?	25	2'-24' (SAA)			36		
					30						
					35						

n: collapse to 12' by well 25-15

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

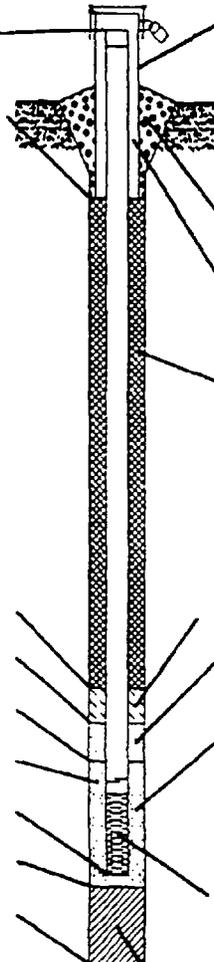
Well Name AS-5  
 Driller/Lic.# Alan Thomas / IN #1807  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 10/28/2002

- Dual Phase Extraction  
 Air Sparge

Drilling Method: DPT (Geoprobe®)  
 1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 7.0 ft.  
 B. Diameter of Well Casing 1.0 in.  
 C. Borehole Diameter 2.25 in.  
 D. Surface Seal Bottom 1.5 ft.  
 E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel



2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post  No  3"  4" qt.  
 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_

5. Annular Space Seal: Granular Bentonite  
 Type: \_\_\_\_\_  
 Amount: \_\_\_\_\_ pounds

Lithology	From	To
Gray clay	0	1.5
Brown, silty sand	1.5	24

How Installed:

- Gravity  
 Tremie Pumped

6. Bentonite Seal:  Granules  
 Pellets  
 7. Type of Fine Sand: None  
 8. Type of Filter Pack: Natural  
 9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 2.0 ft.  
 10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey

Signature: William C. Stuckey

All depths are below ground surface (top of clay)  
 unless otherwise noted.

Facility/Project Name <u>ACS</u> Location <u>Griffin, IN</u>	Boring No. <u>AS-6</u> Project No. _____
Drilling Company <u>Boart Longyear</u> Driller's Name <u>Alan Thomas</u> Driller's Helper <u>Kevin O'Brien</u> Drill Method <u>Geoprobe DPT</u>	State Plane _____ N, _____ E <input type="checkbox"/> N <input type="checkbox"/> Local Grid Location _____ ft <input type="checkbox"/> S _____ ft <input type="checkbox"/> _____ 1/4 of _____ 1/4 of Section _____, T _____ N, R _____ E/W Borehole Diameter _____ Surface Elevation _____ at Screen _____
Water Level <u>N/A</u> Sample Hammer Torque <u>N/A</u>	

Sample No.	Moisture	Blows on Sampler		Sample Recovery	Depth	Logger <u>C. Smith</u>	Editor _____	Penetrometer (Tons/sq. ft.)	PID	Description	Remarks
		0/6	6/12			Start Date <u>10/24/02 1505</u>	End Date <u>1545</u>				
<b>VISUAL CLASSIFICATION</b>											
1				100%	0-4	0-1.3' Stiff tan clay (CL) (cap)					
						1.3'-3.5' Light brown sand (SP), fine to medium grained, loose, dry, trace gravel.			120		
					5	3.5'-4.0' Same as above (SAA) dk gray stained					
2				100%	4'-8'	4.0'-8.0' (SAA) dk gray stained sand banded/layering					
						dk gray 4-4.5'			575		
						lt. gray w/gravel 4.5'-5.5'					
3				60%	8'-12'	8'-12' (SAA) - dk gray stained sand (SP) trace gravel					
						net @ 8'			205		
4				100%	12'-16'	12'-13' (SAA)					
						13'-14.5' Brown sand (SW), trace coarse sand + fine gravel					
					15	free product (brown oily) at 14.5' in gravelly sands sam.			1287		
						14.5'-15.5' dk. gray - black stained sand w/coarse sand + gravel (SW)					
						little					
					20	15.5'-16' lt. brown sand (SW), trace gravel					
5				?	16'-20'	low recovery (SAA) (SW) w/trace gravel					
						(NO CLAY ENCOUNTERED)			1050		
					25	EOB 20'					
						set AS well screen 18'-20'					
					30						
					35						

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

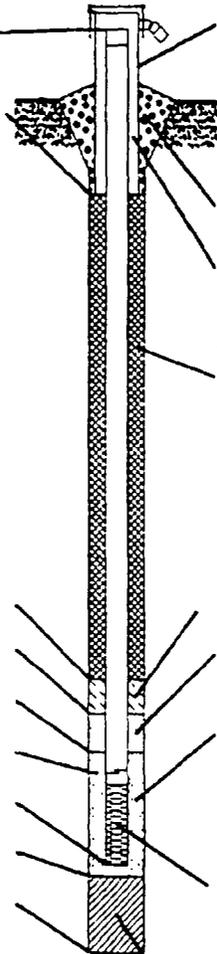
Well Name AS-6  
 Driller/Lic.# Alan Thomas / IN #1807  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203  
 Date 10/24/2002

Type of Well:  
 In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Static Water Level 10 ft.

Drilling Method: DPT (Geoprobe®)  
 1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 2.0 ft.
- B. Diameter of Well Casing 1.0 in.
- C. Borehole Diameter 2.25 in.
- D. Surface Seal Bottom 1.5 ft.
- E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel



- 2. Protective Cover: a. Inside diam.      in.  
 b. Length      ft.  
 c. Material Steel  
 None  
 d. Bumper Post No qty  
     3"      4"
- 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:  
 None  
 Other     

5. Annular Space Seal: Granular Bentonite  
 Type:       
 Amount:      pounds

How Installed:  
 Gravity  
 Tremie Pumped

- 6. Bentonite Seal:  Granules  
 Pellets
- 7. Type of Fine Sand: None
- 8. Type of Filter Pack: Natural

Lithology	From	To
Gray clay	0	1.5
Gray/brown sandy soil	1.5	8
Gray sand, medium	8	20

- F. Bentonite Seal Top 14.0 ft.
- G. Fine Sand Top N/A ft.
- H. Filter Pack Top 16.0 ft.
- I. Screen Joint Top 18.0 ft.
- J. Well Bottom 20.0 ft.
- K. Filter Pack Bottom 24.0 ft.
- L. Borehole Bottom 24.0 ft.

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 2.0 ft.

10. Backfill Material: (Below filter pack)  
None

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey

Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

## **DPE Wells**



# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-43  
 Driller/Lic.# Mike Magnin / IN# 1473  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Static Water Level 10 ft.

Date 11/4/2002

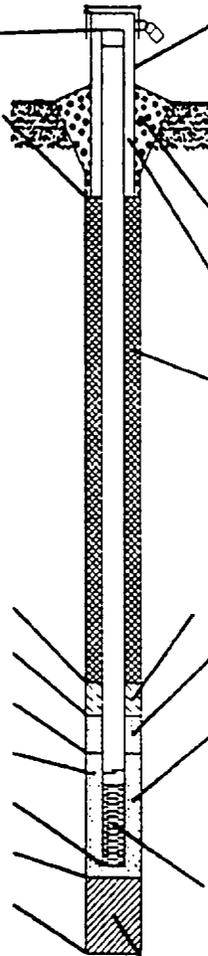
Drilling Method: 8 1/4" HSA

- A. Height of Well Casing above ground 5.0 ft.
- B. Diameter of Well Casing 6.0 in.
- C. Borehole Diameter 12.25 in.
- D. Surface Seal Bottom 1.5 ft.
- E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

Lithology	From	To
Gray clay	0	1.5
Brn/Blk silty sand	1.5	12
Brn/Gry silty sand	12	21

- F. Bentonite Seal Top 1.5 ft.
- G. Fine Sand Top N/A ft.
- H. Filter Pack Top 4.0 ft.
- I. Screen Joint Top 5.0 ft.
- J. Well Bottom 20.0 ft.
- K. Filter Pack Bottom 20.5 ft.
- L. Borehole Bottom 21.0 ft.

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035



- 1. Locking Cap?  Yes  No
- 2. Protective Cover:
  - a. Inside diam. \_\_\_\_\_ in.
  - b. Length \_\_\_\_\_ ft.
  - c. Material Steel  
 None
  - d. Bumper Post  No  3"  4"
- 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:  
 None  
 Other

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 136 pounds

How Installed:  
 Gravity  
 Tremie Pumped

- 6. Bentonite Seal:  Chips  
 Pellets
- 7. Type of Fine Sand: None
- 8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 15.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay)  
 unless otherwise noted.

Facility/Project Name _____ Location _____		Boring No. <u>SVE-46</u> Project No. _____
Drilling Company <u>PLA</u> Driller's Name <u>Alan</u> Driller's Helper <u>Kevin/Chris</u> Drill Method _____		State Plane _____ N. _____ <input type="checkbox"/> N Local Grid Location _____ ft <input type="checkbox"/> S _____ ft <input type="checkbox"/> E _____ 1/4 of _____ 1/4 of Section _____ T _____ N,R _____ E/W Borehole Diameter _____ Surface Elevation _____ at Screen _____
Water Level _____ Sample _____ Hammer Torque _____		

Sample No.	Moisture	Blows on Sampler		Sample Recovery	Depth	Logger <u>C. Smith</u>	Editor _____	Penetrometer (Tons/sq. ft.)	PID	Description	Remarks
		0/6	6/12			Start Date <u>10/29/02 1350</u>	End Date <u>1415</u>				
				100%		<b>VISUAL CLASSIFICATION</b>					
						Blind drill 0'-16'					
						16'-20' 16'-19.5' gray fine sand (sev) w/ trace silt + gravel					
					5	19.5' 1"-thick silt seam					
						19.5'-19.8' - sand (SAA)					
						19.8'-20' gray clayey silt (MB)					
						20' FOB					
					10						
					15						
					20						
					25						
					30						
					35						

# BOART LONGYEAR

## Well Construction Report

**Job Name** American Chemical Service      **Well Name** SVE-46  
**Job Number** 3417-1632      **Driller/Lic.#** Kevin O'Brien / IN# 1937  
**Location** Griffith, IN      **Address** 5815 Churchman Ave., Suite 2  
    Indianapolis, IN 46203

**Type of Well:** In-Situ Soil Vapor Extraction      **Static Water Level** 10 ft.      **Date** 11/5/2002  
 Dual Phase Extraction  
 Air Sparge

**Drilling Method:** 8 1/4" HSA  
**1. Locking Cap?**    Yes     No

- A. **Height of Well Casing above ground** 5.0 ft.
- B. **Diameter of Well Casing** 6.0 in.
- C. **Borehole Diameter** 12.25 in.
- D. **Surface Seal Bottom** 1.5 ft.
- E. **Well Casing:** Flush Threaded PVC  
 Schedule 40 Stainless Steel

- 2. **Protective Cover:**
  - a. **Inside diam.** \_\_\_\_\_ in.
  - b. **Length** \_\_\_\_\_ ft.
  - c. **Material** \_\_\_\_\_  
 Steel  
 None
  - d. **Bumper Post**    No    qty  
                                   3"    4"
- 3. **Surface Seal:** \_\_\_\_\_ Bentonite  
 Concrete  
 Other    Clay

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

**Material between Casing and Protop:**  
 None  
 Other \_\_\_\_\_

**5. Annular Space Seal:**    Bentonite  
**Type:**    3/8" Chips  
**Amount:**    136 pounds

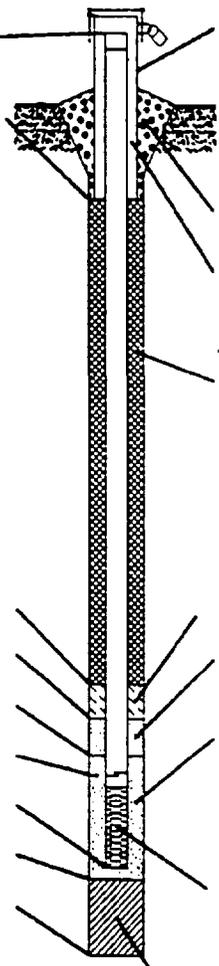
**How Installed:**  
 Gravity  
 Tremie Pumped

- F. **Bentonite Seal Top** 1.5 ft.
- G. **Fine Sand Top** N/A ft.
- H. **Filter Pack Top** 4.0 ft.
- I. **Screen Joint Top** 5.0 ft.
- J. **Well Bottom** 20.0 ft.
- K. **Filter Pack Bottom** 20.5 ft.
- L. **Borehole Bottom** 21.0 ft.

- 6. **Bentonite Seal:** \_\_\_\_\_  
 Chips  
 Pellets
- 7. **Type of Fine Sand:** \_\_\_\_\_  
None
- 8. **Type of Filter Pack:** \_\_\_\_\_  
#5 Sand (Global)

**9. Screen Material:**    Sch. 40 Stainless Steel  
**Type:**    Factory Cut  
 Continuous Slot  
**Slot Size:** 0.010 in.  
**Length:** 15.0 ft.

**10. Backfill Material: (Below filter pack)**  
Natural Cave



Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

**Prepared by:** William C. Stuckey  
**Signature:** *William C. Stuckey*

All depths are below ground surface (top of clay)  
 unless otherwise noted.

# BOART LONGYEAR

**Well Construction Report**

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

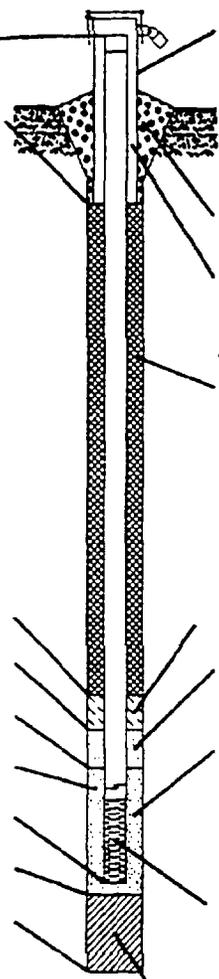
Well Name SVE-47  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203  
 Date 11/12/2002

Type of Well:  
 In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Static Water Level 10 ft.

Drilling Method: 8 1/4" HSA  
 1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 5.5 ft.
- B. Diameter of Well Casing 6.0 in.
- C. Borehole Diameter 12.25 in.
- D. Surface Seal Bottom 1.5 ft.
- E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel



- 2. Protective Cover:
  - a. Inside diam. \_\_\_\_\_ in.
  - b. Length \_\_\_\_\_ ft.
  - c. Material Steel  
 None
  - d. Bumper Post No qty  
 \_\_\_\_\_ 3" \_\_\_\_\_ 4"
- 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 163 pounds

How Installed:  
 Gravity  
 Tremie Pumped

- F. Bentonite Seal Top 1.5 ft.
- G. Fine Sand Top N/A ft.
- H. Filter Pack Top 4.0 ft.
- I. Screen Joint Top 4.5 ft.
- J. Well Bottom 19.5 ft.
- K. Filter Pack Bottom 20.0 ft.
- L. Borehole Bottom 20.0 ft.

- 6. Bentonite Seal:  Chips  
 Pellets
- 7. Type of Fine Sand: None
- 8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 15.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

Facility/Project Name _____ Location _____	Boring No. <u>SVE-48</u> Project No. _____
Drilling Company _____ Driller's Name _____ Driller's Helper _____ Drill Method _____	State Plane _____ N, _____ E <input type="checkbox"/> N <input type="checkbox"/> Local Grid Location _____ ft <input type="checkbox"/> S _____ ft <input type="checkbox"/> _____ 1/4 of _____ 1/4 of Section _____, T _____ N, R _____ E/W Borehole Diameter _____ Surface Elevation _____ at Screen _____
Water Level _____ Sample Hammer Torque _____	

Sample No.	Moisture	Blows on Sampler		Sample Recovery	Depth	Logger <u>C. Smith</u>	Editor _____	Penetrometer (Tons/sq. ft.)	PID	Description	Remarks	
		0/6	6/12			Start Date <u>10/30/14</u>	End Date <u>1/30/15</u>					
				100%	16.20'	<b>VISUAL CLASSIFICATION</b>						
						gray silty sand (uv) transitioning to silt-clay @ 18'20" becoming slightly to med. sand @ 19'20" no clay EOB @ 20'						
					5							
					10							
					15							
					20							
					25							
					30							
					35							

# BOART LONGYEAR

Well Construction Report

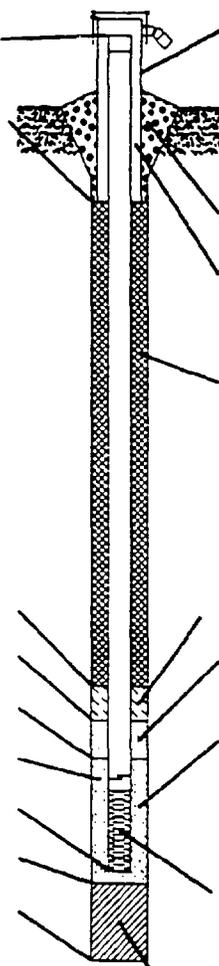
Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-48  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 11/12/2002  
 Dual Phase Extraction  
 Air Sparge

Drilling Method: 8 1/4" HSA  
 1. Locking Cap?      Yes       No

- A. Height of Well Casing above ground 5.0 ft.
- B. Diameter of Well Casing 6.0 in.
- C. Borehole Diameter 12.25 in.
- D. Surface Seal Bottom 1.5 ft.
- E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel



- 2. Protective Cover:
  - a. Inside diam. \_\_\_\_\_ in.
  - b. Length \_\_\_\_\_ ft.
  - c. Material Steel  
 None
  - d. Bumper Post      No      qty  
                                   3"      4"
- 3. Surface Seal: Bentonite  
Concrete  
 Other Clay

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

- Material between Casing and Protop: None  
 Other \_\_\_\_\_
- 5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 190 pounds

How Installed:  
 Gravity  
 Tremie Pumped

- F. Bentonite Seal Top 1.5 ft.
- G. Fine Sand Top N/A ft.
- H. Filter Pack Top 4.0 ft.
- I. Screen Joint Top 5.0 ft.
- J. Well Bottom 20.0 ft.
- K. Filter Pack Bottom 20.5 ft.
- L. Borehole Bottom 21.0 ft.

- 6. Bentonite Seal: Chips  
 Pellets
- 7. Type of Fine Sand: None
- 8. Type of Filter Pack: #5 Sand (Global)
- 9. Screen Material: Sch. 40 Stainless Steel  
 Type: Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 15.0 ft.

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

- 10. Backfill Material: (Below filter pack)  
Natural Cave

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-49  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 11/11/2002

Dual Phase Extraction  
 Air Sparge

Drilling Method: 8 1/4" HSA

1. Locking Cap?      Yes       No

A. Height of Well Casing above ground 5.0 ft.

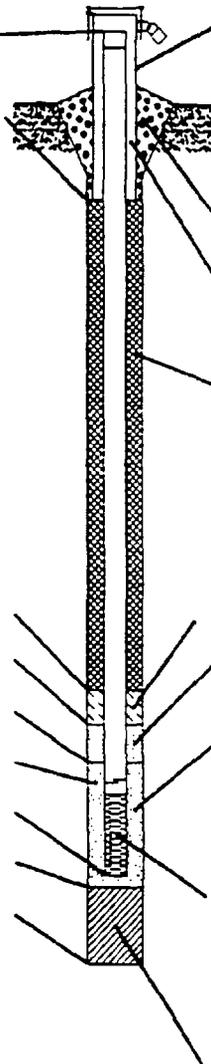
B. Diameter of Well Casing 6.0 in.

C. Borehole Diameter 12.25 in.

D. Surface Seal Bottom 1.5 ft.

E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	



2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post      No      qty  
    3"      4"

3. Surface Seal: Bentonite  
Concrete  
 Other      Clay

Material between Casing and Protop:  
 None  
 Other

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 190 pounds

How Installed:

Gravity  
 Tremie Pumped

6. Bentonite Seal:  Chips  
 Pellets

7. Type of Fine Sand: None

8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type: Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 15.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

F. Bentonite Seal Top 1.5 ft.

G. Fine Sand Top N/A ft.

H. Filter Pack Top 4.0 ft.

I. Screen Joint Top 5.0 ft.

J. Well Bottom 20.0 ft.

K. Filter Pack Bottom 20.0 ft.

L. Borehole Bottom 20.0 ft.

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey

Signature: William C. Stuckey

All depths are below ground surface (top of clay)  
 unless otherwise noted.

Facility/Project Name _____ Location _____	Boring No. <u>SVE-50</u> Project No. _____
Drilling Company _____ Driller's Name _____ Driller's Helper _____ Drill Method _____	State Plane _____ N, _____ E <input type="checkbox"/> N <input type="checkbox"/> E Local Grid Location _____ ft <input type="checkbox"/> S _____ ft <input type="checkbox"/> V _____ 1/4 of _____ 1/4 of Section _____, T _____ N, R _____ EW Borehole Diameter _____ Surface Elevation _____ at Screen _____
Water Level _____ Sample Hammer Torque _____	

Sample No.	Moisture	Blows on Sampler		Sample Recovery	Depth	Logger <u>C. Smith</u> Start Date <u>10/29/02 1435</u>	Editor _____ End Date <u>1450</u>	Penetrometer (Tons/sq. ft.)	PID	Description	Remarks
		0/6	8/12								
				100%		<b>VISUAL CLASSIFICATION</b>					
					0'-17'	Blind drill					
					17'-21'	17'-17.5' black stained sand (Sw) trace gravel; fine sand					
				5	17.5'-19'	gray sand (Sw)					
					19"	- 1" clayey silt (ML) hard, stiff					
				10	19'-21'	gray sand (Sw) trace gravel wet					
					21'	EOB					
				15							
				20							
				25							
				30							
				35							

# BOART LONGYEAR

Well Construction Report

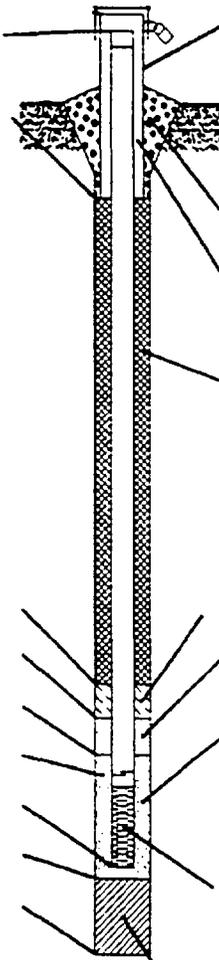
Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-50  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: \_\_\_\_\_ Static Water Level \_\_\_\_\_ Date 11/1/2002  
 In-Situ Soil Vapor Extraction \_\_\_\_\_ 10 ft.  
 Dual Phase Extraction \_\_\_\_\_  
 Air Sparge \_\_\_\_\_

Drilling Method: 8 1/4" HSA  
 1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 4.0 ft.
- B. Diameter of Well Casing 6.0 in.
- C. Borehole Diameter 12.25 in.
- D. Surface Seal Bottom 1.5 ft.
- E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel



- 2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post  No  3"  4"
- 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 136 pounds

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

How Installed:  
 Gravity  
 Tremie Pumped

- F. Bentonite Seal Top 3.0 ft.
- G. Fine Sand Top N/A ft.
- H. Filter Pack Top 5.0 ft.
- I. Screen Joint Top 6.0 ft.
- J. Well Bottom 21.0 ft.
- K. Filter Pack Bottom 21.5 ft.
- L. Borehole Bottom 22.0 ft.

- 6. Bentonite Seal:  Chips  
 Pellets
- 7. Type of Fine Sand: None
- 8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 15.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

Facility/Project Name _____ Location _____	Boring No. <u>SVE-55</u> Project No. _____
Drilling Company _____ Driller's Name _____ Driller's Helper _____ Drill Method _____	State Plane _____ N, _____ <input type="checkbox"/> N Local Grid Location _____ ft <input type="checkbox"/> S _____ ft <input type="checkbox"/> V _____ 1/4 of _____ 1/4 of Section _____, T _____ N,R _____ EW Borehole Diameter _____ Surface Elevation _____ at Screen _____
Water Level _____ Sample Hammer Torque _____	

Sample No.	Moisture	Blows on Sampler		Sample Recovery	Depth	Logger <u>C. Smith</u>	Editor _____	Penetrometer (Tons/sq. ft.)	PID	Description	FID	Remarks
		0/6	8/12			Start Date <u>10/30/02 1330</u>	End Date _____					
<b>VISUAL CLASSIFICATION</b>												
1				100%	16-20'	gray silty sand			9		38	
						1" silt seam at 17'						
					5	19.2'-19.7' 6" clayey silt seam (MC-6)						
						5 6 ft. out bed. new plus						
						17.7'-20' same, worse w/d. 19						
						FDB						
					10							
					15							
					20							
					25							
					30							
					35							

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-55  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 11/11/2002

Dual Phase Extraction  
 Air Sparge

Drilling Method: 8 1/4" HSA  
 1. Locking Cap?     Yes     No

- A. Height of Well Casing above ground 5.0 ft.
- B. Diameter of Well Casing 6.0 in.
- C. Borehole Diameter 12.25 in.
- D. Surface Seal Bottom 1.5 ft.
- E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

- 2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post  No  3"  4" qty
- 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

- Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_
- 5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 190 pounds

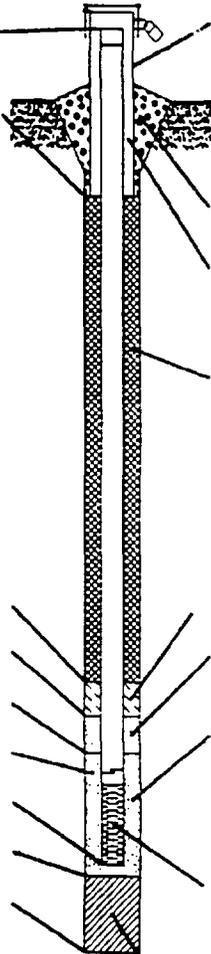
How Installed:  
 Gravity  
 Tremie Pumped

- F. Bentonite Seal Top 1.5 ft.
- G. Fine Sand Top N/A ft.
- H. Filter Pack Top 4.0 ft.
- I. Screen Joint Top 5.0 ft.
- J. Well Bottom 20.0 ft.
- K. Filter Pack Bottom 20.5 ft.
- L. Borehole Bottom 21.0 ft.

- 6. Bentonite Seal:  Chips  
 Pellets
- 7. Type of Fine Sand: None
- 8. Type of Filter Pack: #5 Sand (Global)

- 9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 15.0 ft.

- 10. Backfill Material: (Below filter pack)  
Natural Cave



Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

Facility/Project Name _____ Location _____	Boring No. <u>SVE-57</u> Project No. _____
Drilling Company _____ Driller's Name _____ Driller's Helper _____ Drill Method _____	State Plane _____ N, _____ F <input type="checkbox"/> N <input type="checkbox"/> S Local Grid Location _____ ft _____ ft _____ 1/4 of _____ 1/4 of Section _____, T _____ N, R _____ EW Borehole Diameter _____ Surface Elevation _____ at Screen _____
Water Level _____ Sample Hammer Torque _____	

Sample No.	Moisture	Blows on Sampler		Sample Recovery	Depth	VISUAL CLASSIFICATION		Penetrometer (Tone/sq. ft.)	PID	Description	Remarks
		0/6	6/12			Logger	Editor				
						Logger <u>C. Smith</u>	Editor _____				
						Start Date <u>10/30/22</u>	End Date <u>11/10</u>				
1				100%	16'-20'	gray silty fine sand with gravel to med. coarse sand with some silt trace gravel throughout no clay					FID
					5	EoB 20					99
					10						
					15						
					20						
					25						
					30						
					35						

# BOART LONGYEAR

Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

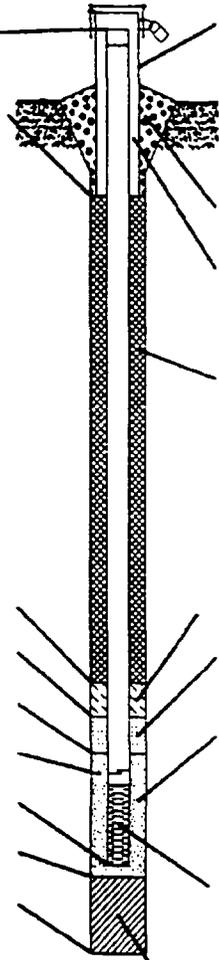
Well Name SVE-57  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 11/14/2002

In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Drilling Method: 8 1/4" HSA  
 1. Locking Cap?     Yes     No

- A. Height of Well Casing above ground 5.0 ft.
- B. Diameter of Well Casing 6.0 in.
- C. Borehole Diameter 12.25 in.
- D. Surface Seal Bottom 1.5 ft.
- E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel



- 2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post     No     3"     4"     4"
- 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 136 pounds

How Installed:  
 Gravity  
 Tremie Pumped

6. Bentonite Seal:  
 Chips  
 Pellets

7. Type of Fine Sand: None

8. Type of Filter Pack: #5 Sand (Global)

- F. Bentonite Seal Top 1.5 ft.
- G. Fine Sand Top N/A ft.
- H. Filter Pack Top 4.0 ft.
- I. Screen Joint Top 5.0 ft.
- J. Well Bottom 20.0 ft.
- K. Filter Pack Bottom 20.5 ft.
- L. Borehole Bottom 21.0 ft.

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 15.0 ft.

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

10. Backfill Material: (Below filter pack)  
Natural Cave

All depths are below ground surface (top of clay) unless otherwise noted.

Prepared by: William C. Stuckey  
 Signature: *William C. Stuckey*





# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

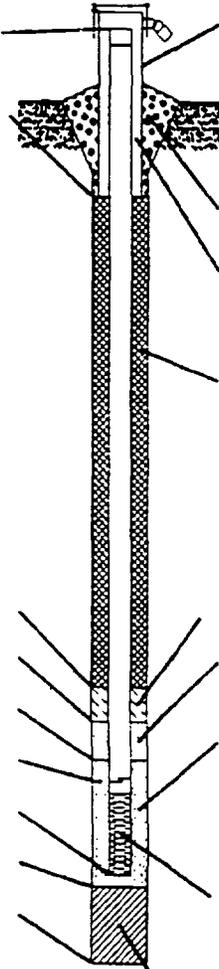
Well Name SVE-63  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203  
 Date 11/13/2002

Type of Well:  
 In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Static Water Level 10 ft.

Drilling Method: 8 1/4" HSA  
 1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 3.0 ft.
- B. Diameter of Well Casing 6.0 in.
- C. Borehole Diameter 12.25 in.
- D. Surface Seal Bottom 1.5 ft.
- E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel



- 2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post  No  3"  4"
- 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 245 pounds

How Installed:  
 Gravity  
 Tremie Pumped

- 6. Bentonite Seal:  Chips  
 Pellets
- 7. Type of Fine Sand: None
- 8. Type of Filter Pack: #5 Sand (Global)
- 9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 15.0 ft.

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

- F. Bentonite Seal Top 1.5 ft.
- G. Fine Sand Top N/A ft.
- H. Filter Pack Top 6.0 ft.
- I. Screen Joint Top 7.0 ft.
- J. Well Bottom 22.0 ft.
- K. Filter Pack Bottom 22.5 ft.
- L. Borehole Bottom 23.0 ft.

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

10. Backfill Material: (Below filter pack)  
Natural Cave  
 Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.



# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

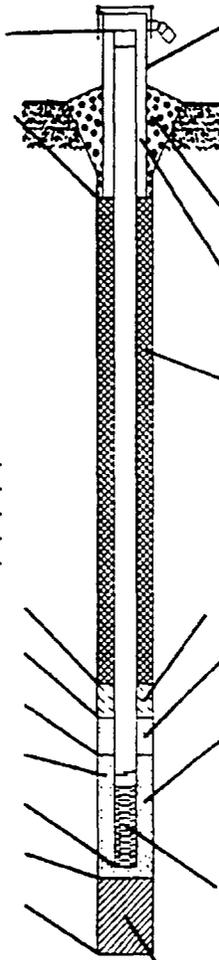
Well Name SVE-65  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: \_\_\_\_\_ Static Water Level 10 ft. Date 11/13/2002

- In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Drilling Method: 8 1/4" HSA  
 1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 3.0 ft.  
 B. Diameter of Well Casing 6.0 in.  
 C. Borehole Diameter 12.25 in.  
 D. Surface Seal Bottom 1.5 ft.  
 E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel



2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post  No  3"  4"  
 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 245 pounds

How Installed:  
 Gravity  
 Tremie Pumped

6. Bentonite Seal:  Chips  
 Pellets  
 7. Type of Fine Sand: None  
 8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 15.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

- F. Bentonite Seal Top 1.5 ft.  
 G. Fine Sand Top N/A ft.  
 H. Filter Pack Top 6.0 ft.  
 I. Screen Joint Top 7.0 ft.  
 J. Well Bottom 22.0 ft.  
 K. Filter Pack Bottom 22.5 ft.  
 L. Borehole Bottom 23.0 ft.

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey

Signature: William C. Stuckey

All depths are below ground surface (top of clay)  
 unless otherwise noted.



Facility/Project Name _____ Location _____	Boring No. <u>SVE-69</u> Project No. _____
Drilling Company _____ Driller's Name _____ Driller's Helper _____ Drill Method _____	State Plane _____ N, _____ ) <input type="checkbox"/> N Local Grid Location _____ ft <input type="checkbox"/> S _____ ft <input type="checkbox"/> _____ 1/4 of _____ 1/4 of Section _____, T _____ N,R _____ EW Borehole Diameter _____ Surface Elevation _____ at Screen _____
Water Level _____ Sample Hammer Torque _____	

Sample No.	Moisture	Blows on Sampler		Sample Recovery	Depth	Logger <u>C. Smith</u> Start Date <u>10/30/02</u> #115	Editor _____ End Date <u>11/5/02</u>	Penetrometer (Tons/sq. ft.)	PID	Description	Remarks
		0/6	6/12								
				100%	16' to	<b>VISUAL CLASSIFICATION</b>					
					5	gray sand (sw) silty fracture gravel coarsens from fine to med grain with depth, w/ trace gravel stiff clay silt lenses at 17.3' - 18.2'					
						FUB 2'					
					10						
					15						
					20						
					25						
					30						
					35						

# BOART LONGYEAR

Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

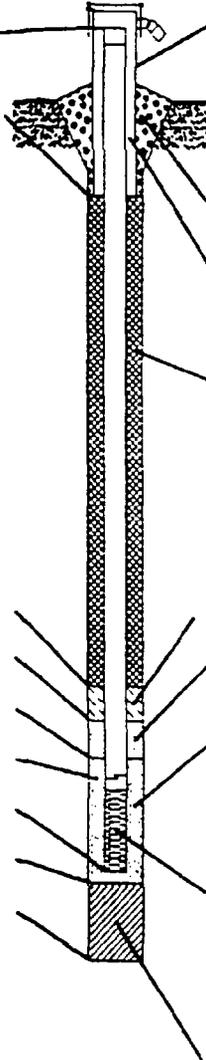
Well Name SVE-69  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 11/14/2002  
 Dual Phase Extraction  
 Air Sparge  
 Drilling Method: 8 1/4" HSA  
 1. Locking Cap?     Yes     No

- A. Height of Well Casing above ground 5.0 ft.
- B. Diameter of Well Casing 6.0 in.
- C. Borehole Diameter 12.25 in.
- D. Surface Seal Bottom 1.5 ft.
- E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

- F. Bentonite Seal Top 1.5 ft.
- G. Fine Sand Top N/A ft.
- H. Filter Pack Top 4.0 ft.
- I. Screen Joint Top 5.0 ft.
- J. Well Bottom 20.0 ft.
- K. Filter Pack Bottom 20.5 ft.
- L. Borehole Bottom 21.0 ft.



- 2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post  No     3"     4"
- 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay
- Material between Casing and Protop:  None  
 Other \_\_\_\_\_
- 5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 136 pounds

How Installed:  
 Gravity  
 Tremie Pumped

- 6. Bentonite Seal:  Chips  
 Pellets
- 7. Type of Fine Sand: None
- 8. Type of Filter Pack: #5 Sand (Global)
- 9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 15.0 ft.
- 10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

Facility/Project Name _____ Location _____	Boring No. <u>SVE-77</u> Project No. _____
Drilling Company _____ Driller's Name _____ Driller's Helper _____ Drill Method _____	State Plane _____ N, _____ <input type="checkbox"/> N Local Grid Location _____ ft <input type="checkbox"/> S _____ ft <input type="checkbox"/> _____ 1/4 of _____ 1/4 of Section _____, T _____ N,R _____ EW Borehole Diameter _____ Surface Elevation _____ at Screen _____
Water Level _____ Sample Hammer Torque _____	

Sample No.	Moisture	Blows on Sampler		Sample Recovery	Depth	VISUAL CLASSIFICATION	Penetrometer (Tons/sq. ft.)	PID	Description	Remarks
		0/6	6/12							
1				100%	16'-20'	16-20' gray silty sand (su), sat. no gravel. fine sand grades to coarse sand (med. coarse) at 18' w/ trace gravel				
					5					
					10					
					15					
					20					
					25					
					30					
					35					





# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

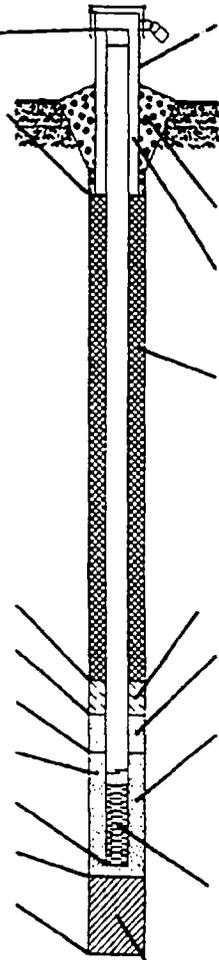
Well Name SVE-78  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: In-Situ Soil Vapor Extraction Static Water Level 10 ft. Date 11/14/2002

- In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Drilling Method: 8 1/4" HSA  
 1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 5.0 ft.  
 B. Diameter of Well Casing 6.0 in.  
 C. Borehole Diameter 12.25 in.  
 D. Surface Seal Bottom 1.5 ft.  
 E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel



2. Protective Cover: a. Inside diam.      in.  
 b. Length      ft.  
 c. Material Steel  
 None  
 d. Bumper Post No qty  
     3"      4"  
 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:  
 None  
 Other       
 5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 136 pounds

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

How Installed:  
 Gravity  
 Tremie Pumped

- F. Bentonite Seal Top 1.5 ft.  
 G. Fine Sand Top N/A ft.  
 H. Filter Pack Top 4.0 ft.  
 I. Screen Joint Top 5.0 ft.  
 J. Well Bottom 20.0 ft.  
 K. Filter Pack Bottom 20.5 ft.  
 L. Borehole Bottom 21.0 ft.

6. Bentonite Seal:  Chips  
 Pellets  
 7. Type of Fine Sand: None  
 8. Type of Filter Pack: #5 Sand (Global)  
 9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 15.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay)  
 unless otherwise noted.

Facility/Project Name _____ Location _____	Boring No. <u>SVE-79</u> Project No. _____
Drilling Company _____ Driller's Name _____ Driller's Helper _____ Drill Method _____	State Plane _____ N, _____ E <input type="checkbox"/> N <input type="checkbox"/> E Local Grid Location _____ ft <input type="checkbox"/> S _____ ft <input type="checkbox"/> E _____ 1/4 of _____ 1/4 of Section _____, T _____ N, R _____ E/W Borehole Diameter _____ Surface Elevation _____ at Screen _____
Water Level _____ Sample Hammer Torque _____	

Sample No.	Moisture	Blows on Sampler		Sample Recovery	Depth	Logger <u>C. Smith</u> <u>1515</u> Editor <u>1530</u> Start Date <u>10/29/02</u> <u>1530</u> End Date <u>1548</u>		Penetrometer (Tons/sq. ft.)	PID	Description	Remarks
		0/6	6/12			VISUAL CLASSIFICATION					
				100%							
					5						
					10						
					15						
					20						
					25						
					30						
					35						



# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-79  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203  
 Date 11/5/2002

Type of Well:  
 In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Static Water Level 10 ft.

Drilling Method: 8 1/4" HSA  
 1. Locking Cap?  Yes  No

A. Height of Well Casing above ground 5.0 ft.

B. Diameter of Well Casing 6.0 in.

C. Borehole Diameter 12.25 in.

D. Surface Seal Bottom 1.5 ft.

E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

F. Bentonite Seal Top 1.5 ft.

G. Fine Sand Top N/A ft.

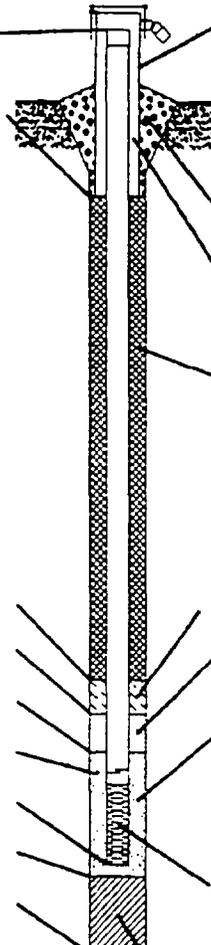
H. Filter Pack Top 4.0 ft.

I. Screen Joint Top 5.0 ft.

J. Well Bottom 20.0 ft.

K. Filter Pack Bottom 20.5 ft.

L. Borehole Bottom 21.0 ft.



2. Protective Cover:  
 a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material  
 Steel  
 None  
 d. Bumper Post  No  3"  4" qty

3. Surface Seal:  Bentonite  
 Concrete  
 Other  Clay

Material between Casing and Protop:  
 None  
 Other

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 136 pounds

How Installed:  
 Gravity  
 Tremie Pumped

6. Bentonite Seal:  
 Chips  
 Pellets

7. Type of Fine Sand: None

8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 15.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey

Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

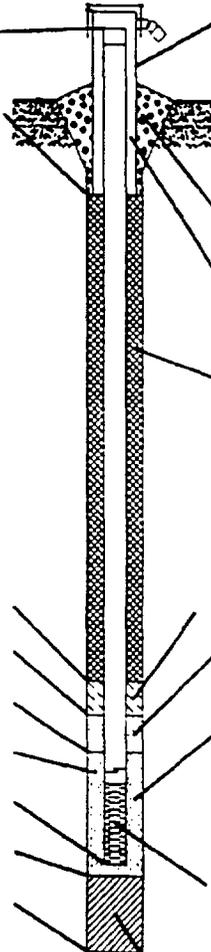
Well Name SVE-80  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 11/7/2002

- In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Drilling Method: 8 1/4" HSA  
 1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 5.0 ft.  
 B. Diameter of Well Casing 6.0 in.  
 C. Borehole Diameter 12.25 in.  
 D. Surface Seal Bottom 1.5 ft.  
 E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel



2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post  No  Yes  
 \_\_\_\_\_ 3" \_\_\_\_\_ 4"
3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 136 pounds

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

How Installed:  
 Gravity  
 Tremie Pumped

- F. Bentonite Seal Top 1.5 ft.  
 G. Fine Sand Top N/A ft.  
 H. Filter Pack Top 4.0 ft.  
 I. Screen Joint Top 5.0 ft.  
 J. Well Bottom 20.0 ft.  
 K. Filter Pack Bottom 20.5 ft.  
 L. Borehole Bottom 21.0 ft.

6. Bentonite Seal:  Chips  
 Pellets
7. Type of Fine Sand: None
8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 15.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

Facility/Project Name \_\_\_\_\_ Boring No. SVE-82  
 Location \_\_\_\_\_ Project No. \_\_\_\_\_

Drilling Company \_\_\_\_\_ State Plane \_\_\_\_\_ N, \_\_\_\_\_  
 Driller's Name \_\_\_\_\_  N  
 Driller's Helper \_\_\_\_\_ Local Grid Location \_\_\_\_\_ ft  S \_\_\_\_\_ ft  W  
 Drill Method \_\_\_\_\_ \_\_\_\_\_ 1/4 of \_\_\_\_\_ 1/4 of Section \_\_\_\_\_, T \_\_\_\_\_ N,R \_\_\_\_\_ E/W  
 Water Level \_\_\_\_\_ Sample Hammer Torque \_\_\_\_\_ Surface Elevation \_\_\_\_\_ Borehole Diameter \_\_\_\_\_ at Screen \_\_\_\_\_

Logger C. Smith Editor \_\_\_\_\_  
 Start Date 10/30/02 0840 End Date 0900

Sample No.	Moisture	Blows on Sampler		Sample Recovery	Depth	VISUAL CLASSIFICATION	Penetrometer (Tons/sq. ft.)	PID	Description	Remarks
		0/6	6/12							
1				100%		11'-20' 11'-20' g. sup. 1.5 in. s. (fy sand (3W)) in. to 10' 20' 1" silt seam @ 19.5' 20' EOB		X		
					5					
					10					
					15					
					20					
					25					
					30					
					35					

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-82  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 11/7/2002

- In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Drilling Method: 8 1/4" HSA  
 1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 5.0 ft.  
 B. Diameter of Well Casing 6.0 in.  
 C. Borehole Diameter 12.25 in.  
 D. Surface Seal Bottom 1.5 ft.  
 E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post  No  Qty  
 \_\_\_\_\_ 3" \_\_\_\_\_ 4"  
 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_  
 5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 136 pounds

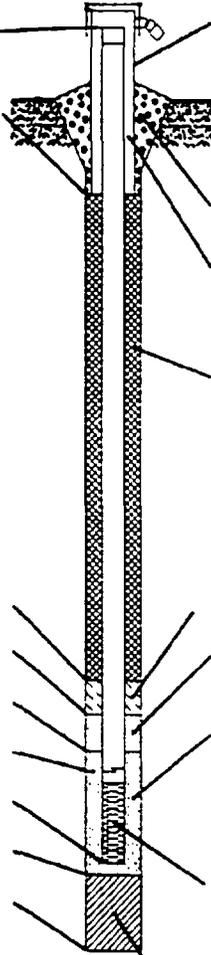
How Installed:  
 Gravity  
 Tremie Pumped

- F. Bentonite Seal Top 1.5 ft.  
 G. Fine Sand Top N/A ft.  
 H. Filter Pack Top 4.0 ft.  
 I. Screen Joint Top 5.0 ft.  
 J. Well Bottom 20.0 ft.  
 K. Filter Pack Bottom 20.5 ft.  
 L. Borehole Bottom 21.0 ft.

6. Bentonite Seal:  Chips  
 Pellets  
 7. Type of Fine Sand: None  
 8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 15.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave



Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-84  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 11/8/2002  
 Dual Phase Extraction  
 Air Sparge

Drilling Method: 8 1/4" HSA  
 1. Locking Cap?  Yes  No

A. Height of Well Casing above ground 5.0 ft.

B. Diameter of Well Casing 6.0 in.

C. Borehole Diameter 12.25 in.

D. Surface Seal Bottom 1.5 ft.

E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

F. Bentonite Seal Top 1.5 ft.

G. Fine Sand Top N/A ft.

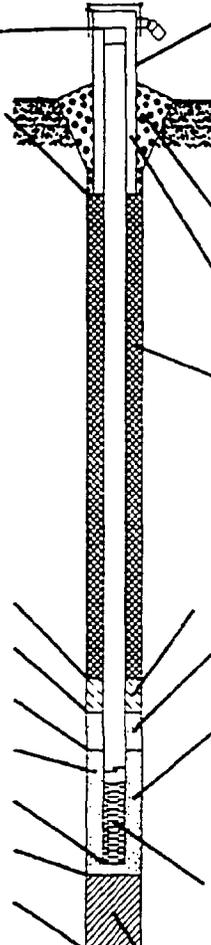
H. Filter Pack Top 4.0 ft.

I. Screen Joint Top 5.0 ft.

J. Well Bottom 20.0 ft.

K. Filter Pack Bottom 20.0 ft.

L. Borehole Bottom 20.0 ft.



2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material \_\_\_\_\_ Steel  
 None  
 d. Bumper Post  No  3"  4"

3. Surface Seal: \_\_\_\_\_ Bentonite  
 \_\_\_\_\_ Concrete  
 Other \_\_\_\_\_ Clay

Material between Casing and Protop:  
 None  
 \_\_\_\_\_ Other

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 136 pounds

How Installed:  
 Gravity  
 Tremie Pumped

6. Bentonite Seal:  Chips  
 Pellets

7. Type of Fine Sand: \_\_\_\_\_ None

8. Type of Filter Pack: \_\_\_\_\_ #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type: \_\_\_\_\_ Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 15.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey

Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

Facility/Project Name _____ Location _____	Boring No. <u>SVE-86</u> Project No. _____
Drilling Company _____ Driller's Name _____ Driller's Helper _____ Drill Method _____	State Plane _____ N. _____ E. _____ <input type="checkbox"/> N <input type="checkbox"/> E Local Grid Location _____ ft <input type="checkbox"/> S _____ ft <input type="checkbox"/> S _____ 1/4 of _____ 1/4 of Section _____, T _____ N, R _____ E/W Borehole Diameter _____ Surface Elevation _____ at Screen _____
Water Level _____ Sample Hammer Torque _____	

Sample No.	Moisture	Blows on Sampler		Sample Recovery	Depth	LOGGER <u>C. Smith</u> Start Date <u>10/30/02 0910</u> End Date <u>0940</u>	Editor _____	Penetrometer (Tons/sq. ft.)	PID	Description	Remarks
		0/6	6/12								
				100%		<b>VISUAL CLASSIFICATION</b>					
					10'-20'	16'-18' - 1 lb brown silty sand (Su) wet, sat. no gravel 18'-18.2' - clayey silt - med stiff 18.2'-19.8' - 1 lb gray sand (Su) wet, fine no gravel 19.8'-20' - gray clayey silt silty clay (cy) stiff - hard dense 19.9'-20' gravelly sand (Su) gray, med to coarse grained. sand. med.					
					5	saturated wet →					
					10						
					15						
					20						
					25						
					30						
					35						

SVE-86

← 16'

→ 20'



# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-86  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: In-Situ Soil Vapor Extraction Static Water Level 10 ft. Date 11/7/2002

- In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Drilling Method: 8 1/4" HSA

1. Locking Cap?  Yes  No

A. Height of Well Casing above ground 5.0 ft.

B. Diameter of Well Casing 6.0 in.

C. Borehole Diameter 12.25 in.

D. Surface Seal Bottom 1.5 ft.

E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

F. Bentonite Seal Top 1.5 ft.

G. Fine Sand Top N/A ft.

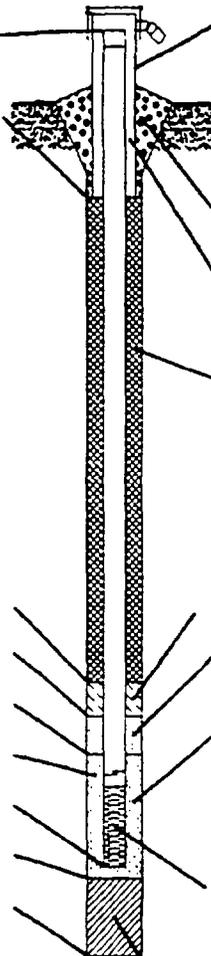
H. Filter Pack Top 4.0 ft.

I. Screen Joint Top 5.0 ft.

J. Well Bottom 20.0 ft.

K. Filter Pack Bottom 20.5 ft.

L. Borehole Bottom 21.0 ft.



2. Protective Cover: a. Inside diam.      in.  
 b. Length      ft.  
 c. Material Steel  
 None  
 d. Bumper Post No qty  
3" 4"

3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:

None  
 Other

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 136 pounds

How Installed:

Gravity  
 Tremie Pumped

6. Bentonite Seal:  Chips  
 Pellets

7. Type of Fine Sand: None

8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 15.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey

Signature: William C. Stuckey

All depths are below ground surface (top of clay)  
 unless otherwise noted.

# BOART LONGYEAR

Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

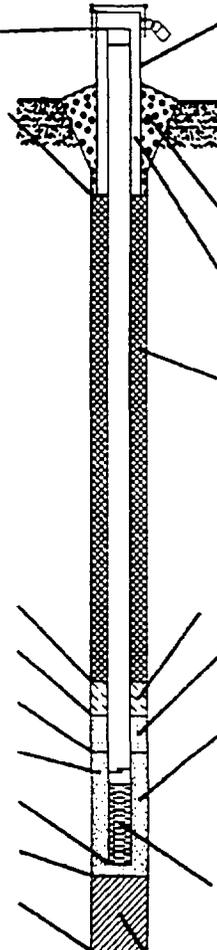
Well Name SVE-87  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 11/8/2002

- In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Drilling Method: 8 1/4" HSA  
 1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 5.0 ft.  
 B. Diameter of Well Casing 6.0 in.  
 C. Borehole Diameter 12.25 in.  
 D. Surface Seal Bottom 1.5 ft.  
 E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel



2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post  No  3"  4"  
 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:  None  
 Other \_\_\_\_\_  
 5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 136 pounds

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

How Installed:  Gravity  
 Tremie Pumped

- F. Bentonite Seal Top 1.5 ft.  
 G. Fine Sand Top N/A ft.  
 H. Filter Pack Top 4.0 ft.  
 I. Screen Joint Top 5.0 ft.  
 J. Well Bottom 20.0 ft.  
 K. Filter Pack Bottom 20.5 ft.  
 L. Borehole Bottom 21.0 ft.

6. Bentonite Seal:  Chips  
 Pellets  
 7. Type of Fine Sand: None  
 8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 15.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay)  
 unless otherwise noted.

**ISVE Wells**



# BOART LONGYEAR

Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-45  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203  
 Date 10/30/2002

Type of Well:  
 In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Static Water Level 10 ft.

Drilling Method: 6 1/4" HSA  
 1. Locking Cap?  Yes  No

A. Height of Well Casing above ground 4.0 ft.

B. Diameter of Well Casing 4.0 in.

C. Borehole Diameter 10.25 in.

D. Surface Seal Bottom 1.5 ft.

E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

F. Bentonite Seal Top 3.0 ft.

G. Fine Sand Top N/A ft.

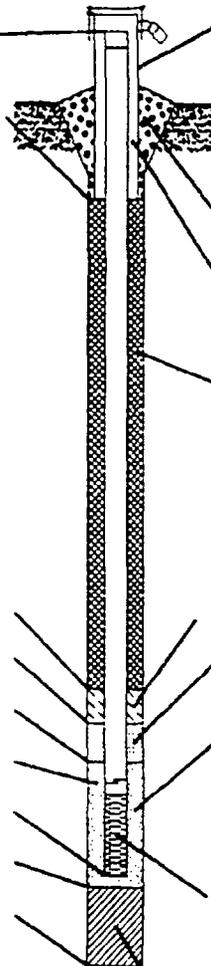
H. Filter Pack Top 5.0 ft.

I. Screen Joint Top 6.0 ft.

J. Well Bottom 21.0 ft.

K. Filter Pack Bottom 21.5 ft.

L. Borehole Bottom 22.0 ft.



2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material \_\_\_\_\_ Steel  
 None  
 d. Bumper Post  No  3"  4"

3. Surface Seal: \_\_\_\_\_ Bentonite  
 \_\_\_\_\_ Concrete  
 Other \_\_\_\_\_ Clay

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 132 pounds

How Installed:  
 Gravity  
 Tremie Pumped

6. Bentonite Seal:  Chips  
 Pellets

7. Type of Fine Sand: \_\_\_\_\_ None

8. Type of Filter Pack: \_\_\_\_\_ #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type: \_\_\_\_\_ Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 15.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey

Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

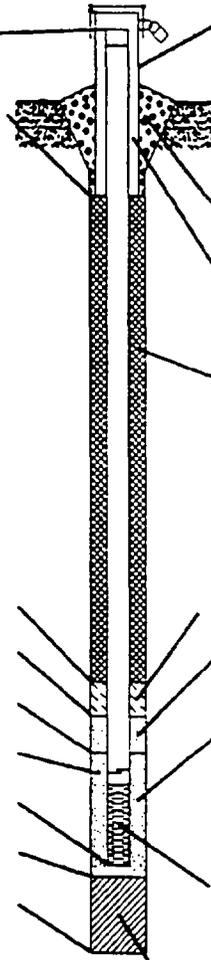
Well Name SVE-51  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well:  In-Situ Soil Vapor Extraction      Static Water Level 10 ft.  
 Dual Phase Extraction  
 Air Sparge  
 Date 10/29/2002  
 Drilling Method: 6 1/4" HSA  
 1. Locking Cap?      Yes       No

- A. Height of Well Casing above ground 5.0 ft.
- B. Diameter of Well Casing 4.0 in.
- C. Borehole Diameter 10.25 in.
- D. Surface Seal Bottom 1.5 ft.
- E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

- F. Bentonite Seal Top 1.5 ft.
- G. Fine Sand Top N/A ft.
- H. Filter Pack Top 4.0 ft.
- I. Screen Joint Top 5.0 ft.
- J. Well Bottom 10.0 ft.
- K. Filter Pack Bottom 10.5 ft.
- L. Borehole Bottom 11.0 ft.



- 2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post      No      qty  
    3"      4"
- 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_  
 5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 94.25 pounds

How Installed:  
 Gravity  
 Tremie Pumped  
 6. Bentonite Seal:  Chips  
 Pellets  
 7. Type of Fine Sand: None

8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-52  
 Driller/Lic.# Kevin O'Brien / IN# 1937  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: X In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 11/1/2002

- X In-Situ Soil Vapor Extraction  
 \_\_\_ Dual Phase Extraction  
 \_\_\_ Air Sparge

Drilling Method: 6 1/4" HSA  
 1. Locking Cap? \_\_\_ Yes X No

A. Height of Well Casing above ground 5.0 ft.

B. Diameter of Well Casing 4.0 in.

C. Borehole Diameter 10.25 in.

D. Surface Seal Bottom 1.5 ft.

E. Well Casing: X Schedule 40 Stainless Steel  
 \_\_\_ Flush Threaded PVC

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

F. Bentonite Seal Top 1.5 ft.

G. Fine Sand Top N/A ft.

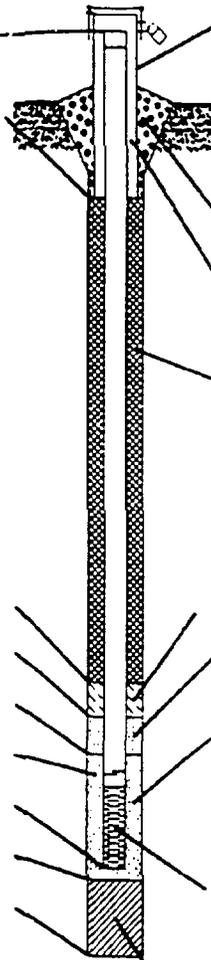
H. Filter Pack Top 4.0 ft.

I. Screen Joint Top 5.0 ft.

J. Well Bottom 10.0 ft.

K. Filter Pack Bottom 10.5 ft.

L. Borehole Bottom 11.0 ft.



2. Protective Cover: a. Inside diam. \_\_\_ in.  
 b. Length \_\_\_ ft.  
 c. Material \_\_\_ Steel  
X None  
 d. Bumper Post \_\_\_ No \_\_\_ 3" \_\_\_ 4" qty

3. Surface Seal: \_\_\_ Bentonite  
 \_\_\_ Concrete  
X Other Clay

Material between Casing and Protop: X None  
 \_\_\_ Other

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 94.25 pounds

How Installed: X Gravity  
 \_\_\_ Tremie Pumped

6. Bentonite Seal: X Chips  
 \_\_\_ Pellets

7. Type of Fine Sand: None

8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type: \_\_\_ Factory Cut  
X Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey

Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

# BOART LONGYEAR

Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-53  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: X In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 11/14/2002

- X In-Situ Soil Vapor Extraction  
 \_\_\_ Dual Phase Extraction  
 \_\_\_ Air Sparge

Drilling Method: 6 1/4" HSA  
 1. Locking Cap? \_\_\_ Yes X No

- A. Height of Well Casing above ground 5.0 ft.  
 B. Diameter of Well Casing 4.0 in.  
 C. Borehole Diameter 10.25 in.  
 D. Surface Seal Bottom 1.5 ft.  
 E. Well Casing: X Flush Threaded PVC  
                   \_\_\_ Schedule 40 Stainless Steel

2. Protective Cover: a. Inside diam. \_\_\_ in.  
 b. Length \_\_\_ ft.  
 c. Material \_\_\_ Steel  
                   X None  
 d. Bumper Post \_\_\_ No \_\_\_ 3" \_\_\_ 4" qty  
 3. Surface Seal: \_\_\_ Bentonite  
                   \_\_\_ Concrete  
                   X Other Clay

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

Material between Casing and Protop: X None  
 \_\_\_ Other  
 5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 132 pounds

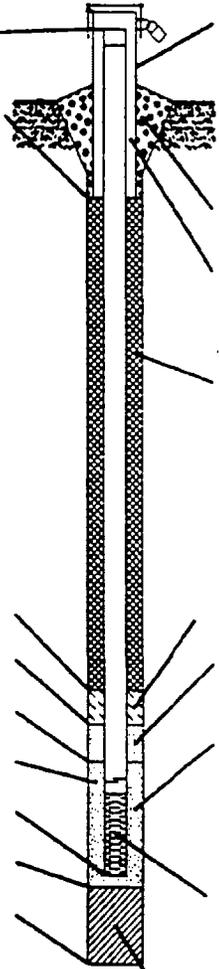
How Installed: X Gravity  
 \_\_\_ Tremie Pumped

- F. Bentonite Seal Top 1.5 ft.  
 G. Fine Sand Top N/A ft.  
 H. Filter Pack Top 4.0 ft.  
 I. Screen Joint Top 5.0 ft.  
 J. Well Bottom 10.0 ft.  
 K. Filter Pack Bottom 10.5 ft.  
 L. Borehole Bottom 11.0 ft.

6. Bentonite Seal: X Chips  
 \_\_\_ Pellets  
 7. Type of Fine Sand: None  
 8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type: \_\_\_ Factory Cut  
           X Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave



Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

# BOART-LONGYEAR

**Well Construction Report**

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-54  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203  
 Date 11/14/2002

Type of Well:  
 In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Static Water Level 10 ft.

Drilling Method: 6 1/4" HSA  
 1. Locking Cap?  Yes  No

A. Height of Well Casing above ground 5.0 ft.

B. Diameter of Well Casing 4.0 in.

C. Borehole Diameter 10.25 in.

D. Surface Seal Bottom 1.5 ft.

E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

F. Bentonite Seal Top 1.5 ft.

G. Fine Sand Top N/A ft.

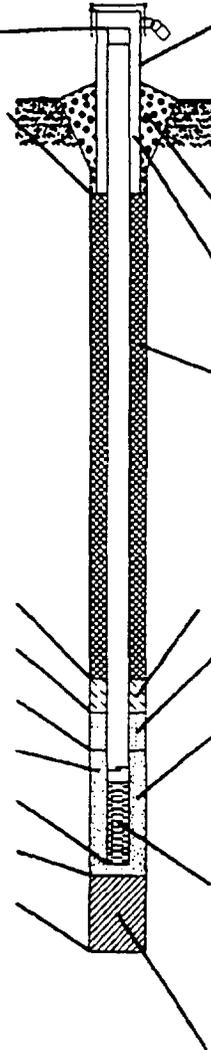
H. Filter Pack Top 4.0 ft.

I. Screen Joint Top 5.0 ft.

J. Well Bottom 10.0 ft.

K. Filter Pack Bottom 10.5 ft.

L. Borehole Bottom 11.0 ft.



2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post  No  Qty \_\_\_\_\_  
3" 4"

3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 132 pounds

How Installed:  
 Gravity  
 Tremie Pumped

6. Bentonite Seal:  Chips  
 Pellets

7. Type of Fine Sand: None

8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey

Signature: William C. Stuckey

All depths are below ground surface (top of clay)  
 unless otherwise noted.

# BOART LONGYEAR

Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-56  
 Driller/Lic.# Kevin O'Brien / IN# 1937  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: X In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 11/7/2002

- X In-Situ Soil Vapor Extraction  
 \_\_\_ Dual Phase Extraction  
 \_\_\_ Air Sparge

Drilling Method: 6 1/4" HSA  
 1. Locking Cap? \_\_\_ Yes X No

- A. Height of Well Casing above ground 5.0 ft.  
 B. Diameter of Well Casing 4.0 in.  
 C. Borehole Diameter 10.25 in.  
 D. Surface Seal Bottom 1.5 ft.  
 E. Well Casing: Flush Threaded PVC  
X Schedule 40 Stainless Steel

2. Protective Cover: a. Inside diam. \_\_\_ in.  
 b. Length \_\_\_ ft.  
 c. Material \_\_\_ Steel  
X None  
 d. Bumper Post \_\_\_ No \_\_\_ 3" \_\_\_ 4" qty  
 3. Surface Seal: \_\_\_ Bentonite  
 \_\_\_ Concrete  
X Other \_\_\_ Clay

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

Material between Casing and Protop:  
X None  
 \_\_\_ Other  
 5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 94.25 pounds

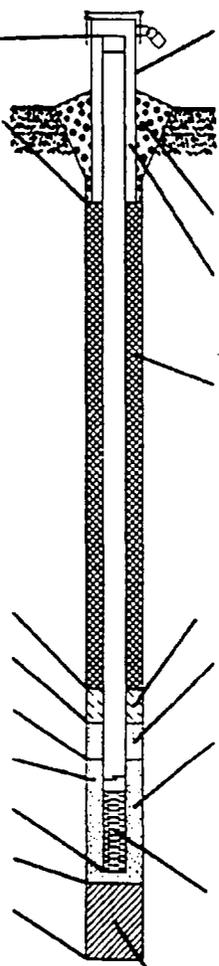
How Installed:  
X Gravity  
 \_\_\_ Tremie Pumped

- F. Bentonite Seal Top 1.5 ft.  
 G. Fine Sand Top N/A ft.  
 H. Filter Pack Top 4.0 ft.  
 I. Screen Joint Top 5.0 ft.  
 J. Well Bottom 10.0 ft.  
 K. Filter Pack Bottom 10.5 ft.  
 L. Borehole Bottom 11.0 ft.

6. Bentonite Seal: X Chips  
 \_\_\_ Pellets  
 7. Type of Fine Sand: \_\_\_ None  
 8. Type of Filter Pack: \_\_\_ #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type: \_\_\_ Factory Cut  
X Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave



Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay)  
 unless otherwise noted.



# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

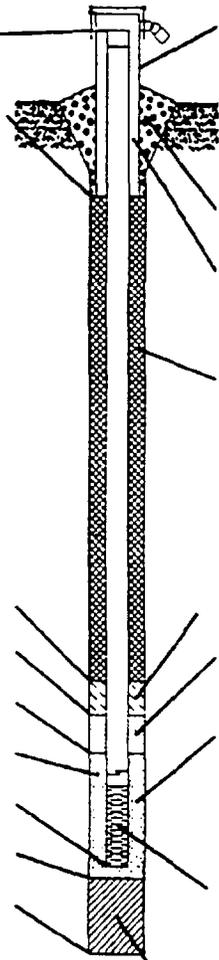
Well Name SVE-59  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203  
 Date 10/30/2002

Type of Well:  
 In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Static Water Level 10 ft.

Drilling Method: 6 1/4" HSA  
 1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 5.0 ft.
- B. Diameter of Well Casing 4.0 in.
- C. Borehole Diameter 10.25 in.
- D. Surface Seal Bottom 1.5 ft.
- E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel



- 2. Protective Cover:
  - a. Inside diam. \_\_\_\_\_ in.
  - b. Length \_\_\_\_\_ ft.
  - c. Material  
 Steel  
 None
  - d. Bumper Post  No  3"  4"
- 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 94.25 pounds

How Installed:  
 Gravity  
 Tremie Pumped

- F. Bentonite Seal Top 1.5 ft.
- G. Fine Sand Top N/A ft.
- H. Filter Pack Top 4.0 ft.
- I. Screen Joint Top 5.0 ft.
- J. Well Bottom 10.0 ft.
- K. Filter Pack Bottom 10.5 ft.
- L. Borehole Bottom 11.0 ft.

- 6. Bentonite Seal:  
 Chips  
 Pellets
- 7. Type of Fine Sand: None
- 8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

# BOART LONGYEAR

Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

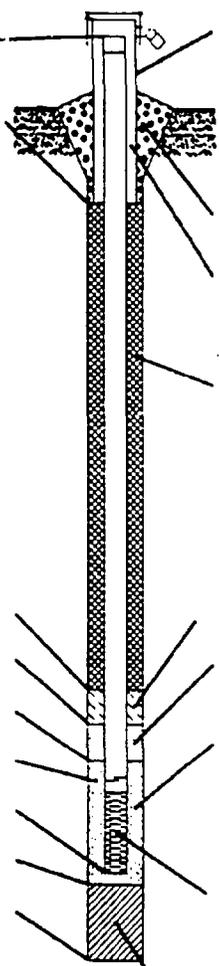
Well Name SVE-60  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: X In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 10/30/2002

- In-Situ Soil Vapor Extraction
- Dual Phase Extraction
- Air Sparge

Drilling Method: 6 1/4" HSA  
 1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 5.0 ft.
- B. Diameter of Well Casing 4.0 in.
- C. Borehole Diameter 10.25 in.
- D. Surface Seal Bottom 1.5 ft.
- E. Well Casing: X Schedule 40 Stainless Steel



- 2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post  No  3"  4" qty
- 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:  None  
 Other \_\_\_\_\_  
 5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 94.25 pounds

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

How Installed:  Gravity  
 Tremie Pumped

- F. Bentonite Seal Top 1.5 ft.
- G. Fine Sand Top N/A ft.
- H. Filter Pack Top 4.0 ft.
- I. Screen Joint Top 5.0 ft.
- J. Well Bottom 10.0 ft.
- K. Filter Pack Bottom 10.5 ft.
- L. Borehole Bottom 11.0 ft.

- 6. Bentonite Seal:  Chips  
 Pellets
- 7. Type of Fine Sand: None
- 8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey  
 Signature: *William C. Stuckey*

All depths are below ground surface (top of clay) unless otherwise noted.

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-62  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203  
 Date 11/15/2002

Type of Well:  
 In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Static Water Level 10 ft.

Drilling Method: 6 1/4" HSA  
 1. Locking Cap?  Yes  No

A. Height of Well Casing above ground 5.0 ft.

B. Diameter of Well Casing 4.0 in.

C. Borehole Diameter 10.25 in.

D. Surface Seal Bottom 1.5 ft.

E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

F. Bentonite Seal Top 1.5 ft.

G. Fine Sand Top N/A ft.

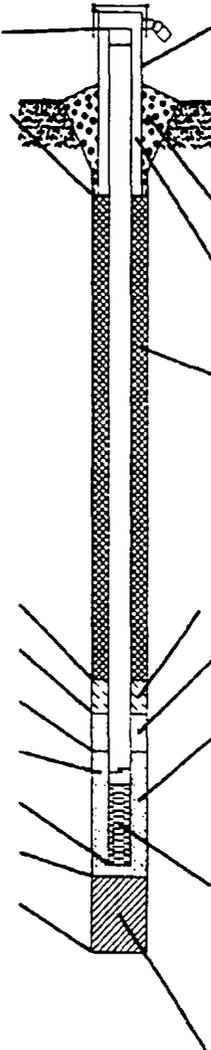
H. Filter Pack Top 4.0 ft.

I. Screen Joint Top 5.0 ft.

J. Well Bottom 10.0 ft.

K. Filter Pack Bottom 10.5 ft.

L. Borehole Bottom 11.0 ft.



2. Protective Cover: a. inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post  No  3"  4"

3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 132 pounds

How Installed:  
 Gravity  
 Tremie Pumped

6. Bentonite Seal:  Chips  
 Pellets

7. Type of Fine Sand: None

8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay)  
 unless otherwise noted.

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-64  
 Driller/Lic.# Kevin O'Brien / IN# 1937  
 Address 5815 Churchman Ave. Suite 2  
Indianapolis, IN 46203

Type of Well: X In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 11/4/2002

- In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Drilling Method: 6 1/4" HSA  
 1. Locking Cap?  Yes  No

A. Height of Well Casing above ground 5.0 ft.

B. Diameter of Well Casing 4.0 in.

C. Borehole Diameter 10.25 in.

D. Surface Seal Bottom 1.5 ft.

E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

F. Bentonite Seal Top 1.5 ft.

G. Fine Sand Top N/A ft.

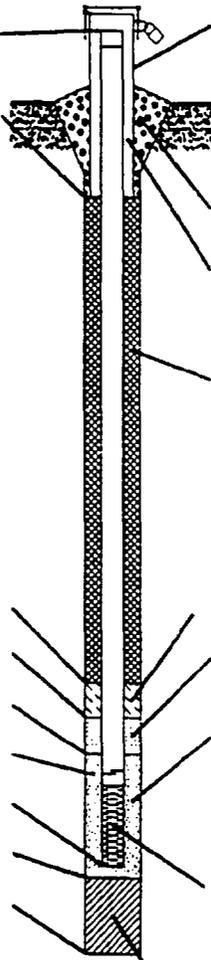
H. Filter Pack Top 4.0 ft.

I. Screen Joint Top 5.0 ft.

J. Well Bottom 10.0 ft.

K. Filter Pack Bottom 10.5 ft.

L. Borehole Bottom 11.0 ft.



2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post  No  3"  4"

3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 94.25 pounds

How Installed:  
 Gravity  
 Tremie Pumped

6. Bentonite Seal:  Chips  
 Pellets

7. Type of Fine Sand: None

8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey

Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.



# BOART LONGYEAR

**Well Construction Report**

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-67  
 Driller/Lic.# Kevin O'Brien / IN# 1937  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203  
 Date 11/7/2002

Type of Well:  
 In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Static Water Level 10 ft.

Drilling Method: 6 1/4" HSA  
 1. Locking Cap?  Yes  No

A. Height of Well Casing above ground 5.0 ft.

B. Diameter of Well Casing 4.0 in.

C. Borehole Diameter 10.25 in.

D. Surface Seal Bottom 1.5 ft.

E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

F. Bentonite Seal Top 1.5 ft.

G. Fine Sand Top N/A ft.

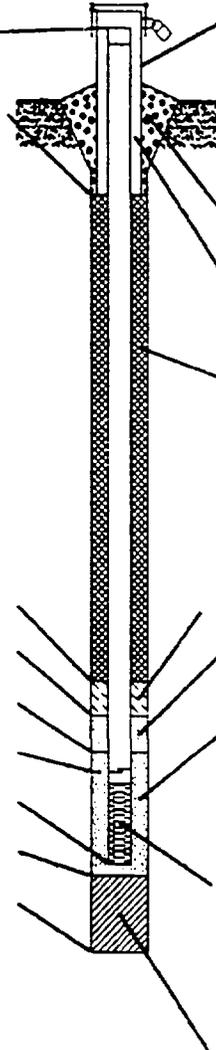
H. Filter Pack Top 4.0 ft.

I. Screen Joint Top 5.0 ft.

J. Well Bottom 10.0 ft.

K. Filter Pack Bottom 10.5 ft.

L. Borehole Bottom 11.0 ft.



2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material \_\_\_\_\_ Steel  
 None  
 d. Bumper Post  No  3"  4" qty

3. Surface Seal:  Bentonite  
 Concrete  
 Other \_\_\_\_\_ Clay

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 94.25 pounds

How Installed:  
 Gravity  
 Tremie Pumped

6. Bentonite Seal:  Chips  
 Pellets

7. Type of Fine Sand: \_\_\_\_\_ None

8. Type of Filter Pack: \_\_\_\_\_ #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey

Signature: William C. Stuckey

All depths are below ground surface (top of clay)  
 unless otherwise noted.

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-68  
 Driller/Lic.# Kevin O'Brien / IN# 1937  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203  
 Date 11/7/2002

Type of Well:  
 In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Static Water Level  
10 ft.

Drilling Method: 6 1/4" HSA  
 1. Locking Cap?  Yes  No

A. Height of Well Casing above ground  
5.0 ft.

B. Diameter of Well Casing  
4.0 in.

C. Borehole Diameter  
10.25 in.

D. Surface Seal Bottom  
1.5 ft.

E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

F. Bentonite Seal Top 1.5 ft.

G. Fine Sand Top N/A ft.

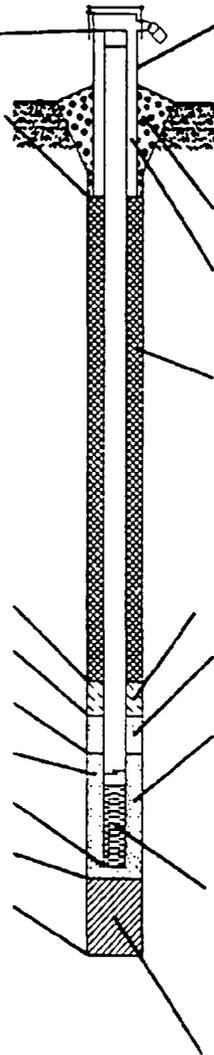
H. Filter Pack Top 4.0 ft.

I. Screen Joint Top 5.0 ft.

J. Well Bottom 10.0 ft.

K. Filter Pack Bottom 10.5 ft.

L. Borehole Bottom 11.0 ft.



2. Protective Cover: a. Inside diam.          in.  
 b. Length          ft.  
 c. Material Steel  
 None  
 d. Bumper Post No qty  
         3"          4"

3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:  
 None  
 Other         

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 94.25 pounds

How Installed:  
 Gravity  
 Tremie Pumped

6. Bentonite Seal:  Chips  
 Pellets

7. Type of Fine Sand:          None

8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

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 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey

Signature: William C. Stuckey

All depths are below ground surface (top of clay)  
 unless otherwise noted.



# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

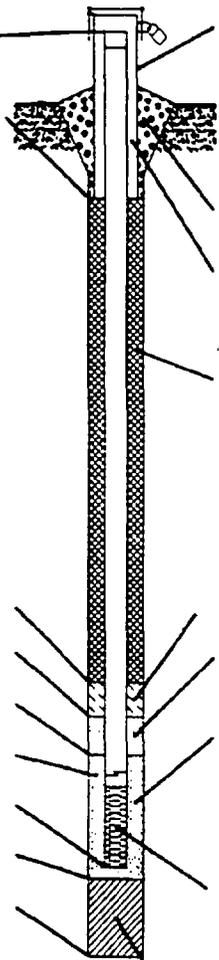
Well Name SVE-71  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203  
 Date 10/30/2002

Type of Well:  
 In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Static Water Level 10 ft.

Drilling Method: 6 1/4" HSA  
 1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 5.0 ft.
- B. Diameter of Well Casing 4.0 in.
- C. Borehole Diameter 10.25 in.
- D. Surface Seal Bottom 1.5 ft.
- E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel



- 2. Protective Cover:
  - a. Inside diam. \_\_\_\_\_ in.
  - b. Length \_\_\_\_\_ ft.
  - c. Material  Steel  None
  - d. Bumper Post  No  3"  4"
- 3. Surface Seal:  Bentonite  Concrete  Other Clay

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 94.25 pounds

How Installed:  
 Gravity  
 Tremie Pumped

- 6. Bentonite Seal:  Chips  Pellets
- 7. Type of Fine Sand: None
- 8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

- F. Bentonite Seal Top 1.5 ft.
- G. Fine Sand Top N/A ft.
- H. Filter Pack Top 4.0 ft.
- I. Screen Joint Top 5.0 ft.
- J. Well Bottom 10.0 ft.
- K. Filter Pack Bottom 10.5 ft.
- L. Borehole Bottom 11.0 ft.

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey  
 Signature: *William C. Stuckey*

All depths are below ground surface (top of clay) unless otherwise noted.



# BOART LONGYEAR

Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

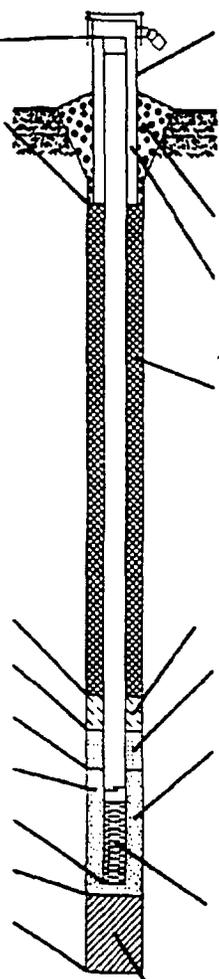
Well Name SVE-73  
 Driller/Lic.# Kevin O'Brien / IN# 1937  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203  
 Date 11/8/2002

Type of Well:  
 In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Static Water Level 10 ft.

Drilling Method: 6 1/4" HSA  
 1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 5.0 ft.
- B. Diameter of Well Casing 4.0 in.
- C. Borehole Diameter 10.25 in.
- D. Surface Seal Bottom 1.5 ft.
- E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel



- 2. Protective Cover:
  - a. Inside diam. \_\_\_\_\_ in.
  - b. Length \_\_\_\_\_ ft.
  - c. Material  Steel  None
  - d. Bumper Post  No  3"  4" qty
- 3. Surface Seal:  Bentonite  Concrete  Other Clay

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 94.25 pounds

How Installed:  
 Gravity  
 Tremie Pumped

- F. Bentonite Seal Top 1.5 ft.
- G. Fine Sand Top N/A ft.
- H. Filter Pack Top 4.0 ft.
- I. Screen Joint Top 5.0 ft.
- J. Well Bottom 10.0 ft.
- K. Filter Pack Bottom 10.5 ft.
- L. Borehole Bottom 11.0 ft.

- 6. Bentonite Seal:  Chips  Pellets
- 7. Type of Fine Sand: None
- 8. Type of Filter Pack: #5 Sand (Global)
- 9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

10. Backfill Material: (Below filter pack)  
Natural Cave

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

# BOART LONGYEAR

**Well Construction Report**

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

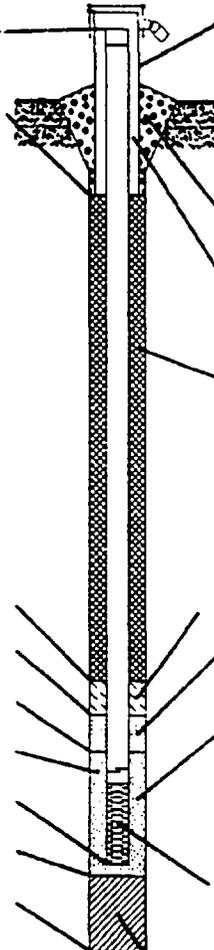
Well Name SVE-74  
 Driller/Lic.# Kevin O'Brien / IN# 1937  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well:  In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 11/8/2002  
 Dual Phase Extraction  
 Air Sparge  
 Drilling Method: 6 1/4" HSA  
 1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 5.0 ft.
- B. Diameter of Well Casing 4.0 in.
- C. Borehole Diameter 10.25 in.
- D. Surface Seal Bottom 1.5 ft.
- E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

- F. Bentonite Seal Top 1.5 ft.
- G. Fine Sand Top N/A ft.
- H. Filter Pack Top 4.0 ft.
- I. Screen Joint Top 5.0 ft.
- J. Well Bottom 10.0 ft.
- K. Filter Pack Bottom 10.5 ft.
- L. Borehole Bottom 11.0 ft.



- 2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post  No  3"  4" qty
- 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:  None  
 Other \_\_\_\_\_  
 5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 94.25 pounds

How Installed:  Gravity  
 Tremie Pumped  
 6. Bentonite Seal:  Chips  
 Pellets  
 7. Type of Fine Sand: None

8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-75  
 Driller/Lic.# Kevin O'Brien / IN# 1937  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203  
 Date 11/7/2002

Type of Well:  
 In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Static Water Level 10 ft.

Drilling Method: 6 1/4" HSA  
 1. Locking Cap?  Yes  No

A. Height of Well Casing above ground 5.0 ft.

B. Diameter of Well Casing 4.0 in.

C. Borehole Diameter 10.25 in.

D. Surface Seal Bottom 1.5 ft.

E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

F. Bentonite Seal Top 1.5 ft.

G. Fine Sand Top N/A ft.

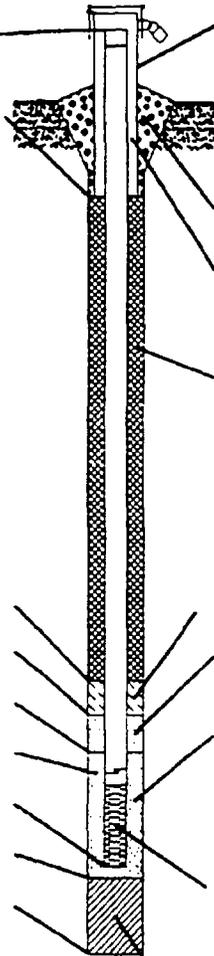
H. Filter Pack Top 4.0 ft.

I. Screen Joint Top 5.0 ft.

J. Well Bottom 10.0 ft.

K. Filter Pack Bottom 10.5 ft.

L. Borehole Bottom 11.0 ft.



2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material \_\_\_\_\_ Steel  
 None  
 d. Bumper Post  No  3"  4" qty

3. Surface Seal: \_\_\_\_\_ Bentonite  
 \_\_\_\_\_ Concrete  
 Other \_\_\_\_\_ Clay

Material between Casing and Protop:  
 None  
 \_\_\_\_\_ Other

5. Annular Space Seal: \_\_\_\_\_ Bentonite  
 Type: 3/8" Chips  
 Amount: 94.25 pounds

How Installed:  
 Gravity  
 Tremie Pumped

6. Bentonite Seal:  Chips  
 Pellets

7. Type of Fine Sand: \_\_\_\_\_ None

8. Type of Filter Pack: \_\_\_\_\_ #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type: \_\_\_\_\_ Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey

Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

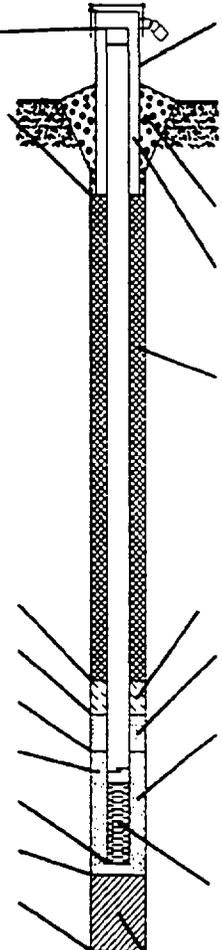
Well Name SVE-76  
 Driller/Lic.# Kevin O'Brien / IN# 1937  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: X In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 11/7/2002

- X In-Situ Soil Vapor Extraction  
 \_\_\_ Dual Phase Extraction  
 \_\_\_ Air Sparge

Drilling Method: 6 1/4" HSA  
 1. Locking Cap? \_\_\_ Yes X No

- A. Height of Well Casing above ground 5.0 ft.  
 B. Diameter of Well Casing 4.0 in.  
 C. Borehole Diameter 10.25 in.  
 D. Surface Seal Bottom 1.5 ft.  
 E. Well Casing: Flush Threaded PVC  
X Schedule 40 Stainless Steel



2. Protective Cover: a. Inside diam. \_\_\_ in.  
 b. Length \_\_\_ ft.  
 c. Material \_\_\_ Steel  
X None  
 d. Bumper Post \_\_\_ No \_\_\_ 3" \_\_\_ 4" qty
3. Surface Seal: \_\_\_ Bentonite  
 \_\_\_ Concrete  
X Other Clay

Material between Casing and Protop: X None  
 \_\_\_ Other

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 94.25 pounds

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

How Installed: X Gravity  
 \_\_\_ Tremie Pumped

- F. Bentonite Seal Top 1.5 ft.  
 G. Fine Sand Top N/A ft.  
 H. Filter Pack Top 4.0 ft.  
 I. Screen Joint Top 5.0 ft.  
 J. Well Bottom 10.0 ft.  
 K. Filter Pack Bottom 10.5 ft.  
 L. Borehole Bottom 11.0 ft.

6. Bentonite Seal: X Chips  
 \_\_\_ Pellets
7. Type of Fine Sand: None
8. Type of Filter Pack: #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type: \_\_\_ Factory Cut  
X Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay)  
 unless otherwise noted.

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-81  
 Driller/Lic.# Dan Harrison / IN# 1687  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well: X In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 11/15/2002

- In-Situ Soil Vapor Extraction  
 Dual Phase Extraction  
 Air Sparge

Drilling Method: 6 1/4" HSA  
 1. Locking Cap?  Yes  No

A. Height of Well Casing above ground 5.0 ft.

B. Diameter of Well Casing 4.0 in.

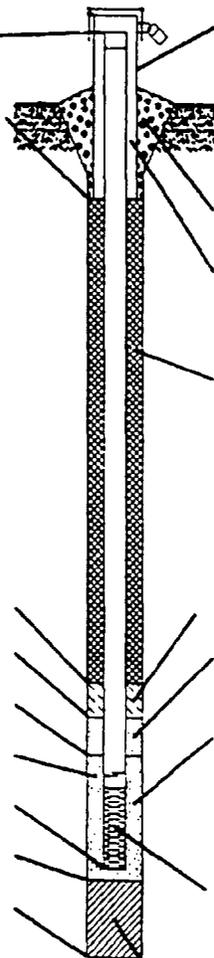
C. Borehole Diameter 10.25 in.

D. Surface Seal Bottom 1.5 ft.

E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

- F. Bentonite Seal Top 1.5 ft.  
 G. Fine Sand Top N/A ft.  
 H. Filter Pack Top 4.0 ft.  
 I. Screen Joint Top 5.0 ft.  
 J. Well Bottom 10.0 ft.  
 K. Filter Pack Bottom 10.5 ft.  
 L. Borehole Bottom 11.0 ft.



2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material \_\_\_\_\_ Steel  
 None  
 d. Bumper Post  No  3"  4" qty

3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 132 pounds

How Installed:  
 Gravity  
 Tremie Pumped

6. Bentonite Seal:  Chips  
 Pellets

7. Type of Fine Sand: \_\_\_\_\_ None

8. Type of Filter Pack: \_\_\_\_\_ #5 Sand (Global)

9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.

10. Backfill Material: (Below filter pack)  
Natural Cave

Boart Longyear  
 5815 Churchman Ave., Suite 2  
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 Phone (317) 784-1838  
 Fax (317) 784-2035

Prepared by: William C. Stuckey

Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.

# BOART LONGYEAR

## Well Construction Report

Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-83  
 Driller/Lic.# Kevin O'Brien / IN# 1937  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

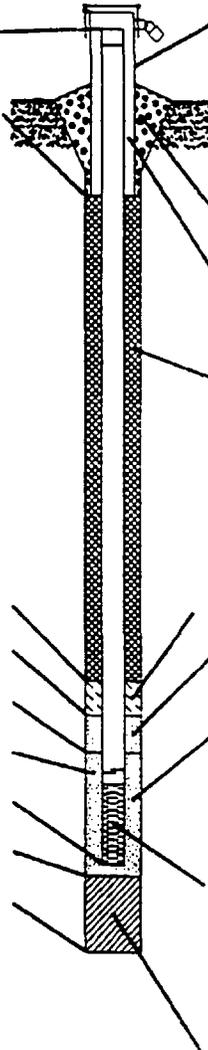
Type of Well:  In-Situ Soil Vapor Extraction      Static Water Level 10 ft.  
 Dual Phase Extraction  
 Air Sparge  
 Date 11/8/2002  
 Drilling Method: 6 1/4" HSA

- A. Height of Well Casing above ground 5.0 ft.  
 B. Diameter of Well Casing 4.0 in.  
 C. Borehole Diameter 10.25 in.  
 D. Surface Seal Bottom 1.5 ft.  
 E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

- F. Bentonite Seal Top 1.5 ft.  
 G. Fine Sand Top N/A ft.  
 H. Filter Pack Top 4.0 ft.  
 I. Screen Joint Top 5.0 ft.  
 J. Well Bottom 10.0 ft.  
 K. Filter Pack Bottom 10.5 ft.  
 L. Borehole Bottom 11.0 ft.

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035



1. Locking Cap?  Yes  No  
 2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material Steel  
 None  
 d. Bumper Post  No  Qty  
 \_\_\_\_\_ 3" \_\_\_\_\_ 4"  
 3. Surface Seal:  Bentonite  
 Concrete  
 Other Clay  
 Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_  
 5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 94.25 pounds

How Installed:  
 Gravity  
 Tremie Pumped

6. Bentonite Seal:  Chips  
 Pellets  
 7. Type of Fine Sand: None  
 8. Type of Filter Pack: #5 Sand (Global)  
 9. Screen Material: Sch. 40 Stainless Steel  
 Type:  Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.  
 10. Backfill Material: (Below filter pack)  
Natural Cave

All depths are below ground surface (top of clay)  
 unless otherwise noted.

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

# BOART LONGYEAR

Well Construction Report

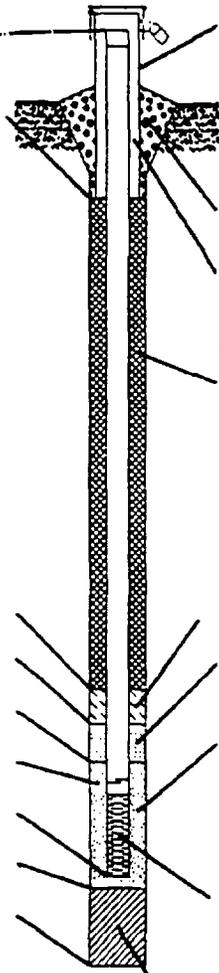
Job Name American Chemical Service  
 Job Number 3417-1632  
 Location Griffith, IN

Well Name SVE-85  
 Driller/Lic.# Kevin O'Brien / IN# 1937  
 Address 5815 Churchman Ave., Suite 2  
Indianapolis, IN 46203

Type of Well:  In-Situ Soil Vapor Extraction      Static Water Level 10 ft.      Date 11/8/2002  
 Dual Phase Extraction  
 Air Sparge

Drilling Method: 6 1/4" HSA  
 1. Locking Cap?  Yes  No

- A. Height of Well Casing above ground 5.0 ft.
- B. Diameter of Well Casing 4.0 in.
- C. Borehole Diameter 10.25 in.
- D. Surface Seal Bottom 1.5 ft.
- E. Well Casing: Flush Threaded PVC  
 Schedule 40 Stainless Steel



- 2. Protective Cover: a. Inside diam. \_\_\_\_\_ in.  
 b. Length \_\_\_\_\_ ft.  
 c. Material \_\_\_\_\_ Steel  
 None  
 d. Bumper Post  No  3"  4" qty
- 3. Surface Seal: \_\_\_\_\_ Bentonite  
 \_\_\_\_\_ Concrete  
 Other \_\_\_\_\_ Clay

Material between Casing and Protop:  
 None  
 Other \_\_\_\_\_

5. Annular Space Seal: Bentonite  
 Type: 3/8" Chips  
 Amount: 94.25 pounds

Lithology	From	To
Gray clay	0	1.5
Not Sampled	1.5+	

How Installed:  
 Gravity  
 Tremie Pumped

- F. Bentonite Seal Top 1.5 ft.
- G. Fine Sand Top N/A ft.
- H. Filter Pack Top 4.0 ft.
- I. Screen Joint Top 5.0 ft.
- J. Well Bottom 10.0 ft.
- K. Filter Pack Bottom 10.5 ft.
- L. Borehole Bottom 11.0 ft.

- 6. Bentonite Seal:  Chips  
 Pellets
- 7. Type of Fine Sand: \_\_\_\_\_ None
- 8. Type of Filter Pack: \_\_\_\_\_ #5 Sand (Global)
- 9. Screen Material: Sch. 40 Stainless Steel  
 Type: \_\_\_\_\_ Factory Cut  
 Continuous Slot  
 Slot Size: 0.010 in.  
 Length: 5.0 ft.

Boart Longyear  
 5815 Churchman Ave., Suite 2  
 Indianapolis, IN 46203  
 Phone (317) 784-1838  
 Fax (317) 784-2035

10. Backfill Material: (Below filter pack)  
Natural Cave

Prepared by: William C. Stuckey  
 Signature: William C. Stuckey

All depths are below ground surface (top of clay) unless otherwise noted.



**APPENDIX D**

**WELL CONSTRUCTION MATERIAL SPECIFICATIONS**

DEPARTMENT OF NATURAL RESOURCES  
WATER WELL DRILLING LICENSE

Division of Water

Kevin M. O'Brien

is entitled to operate well drilling equipment or engage in  
the drilling of wells Pursuant to I.C. 25-39.

Certificate Number 1937	Expiration Date Dec. 31, 2002
Receipt Number 190846	Signature <i>Kevin M. O'Brien</i>

INDIANA WATER WELL DRILLING LICENSE

Department of Natural Resources

Issued by the Division of Water

Daniel L. Harrison

is entitled to operate water well drilling equipment and engage in  
the drilling of water wells, pursuant to Indiana Code 25-39

License Number

1687

Expiration Date

December 31, 2004

DNR Receipt Number

1010417

Signature

*Daniel L. Harrison*

INDIANA WATER WELL DRILLING LICENSE

Department of Natural Resources

Issued by the Division of Water

Alan J. Thomas

is entitled to operate water well drilling equipment and engage in  
the drilling of water wells, pursuant to Indiana Code 25-39.

License Number

1807

Expiration Date

December 31, 2004

DNR Receipt Number

1010417

Signature

*Alan J. Thomas*

INDIANA WATER WELL DRILLING LICENSE

Department of Natural Resources

Issued by the Division of Water

Michael S. Magnin

is entitled to operate water well drilling equipment and engage in  
the drilling of water wells, pursuant to Indiana Code 25-39.

License Number

1473

Expiration Date

December 31, 2004

DNR Receipt Number

1010417

Signature

*Michael S. Magnin*

DEPARTMENT OF NATURAL RESOURCES  
WATER WELL DRILLING LICENSE

Division of Water

William J. Zamow

is entitled to operate well drilling equipment or engage in  
the drilling of wells Pursuant to I.C. 25-39.

Certificate Number 1340	Expiration Date Dec. 31, 2002
Receipt Number 190593	Signature

DEPARTMENT OF NATURAL RESOURCES  
WATER WELL DRILLING LICENSE

Division of Water

William J. Zamow

is entitled to operate well drilling equipment or engage in  
the drilling of wells Pursuant to I.C. 25-39.

Certificate Number 1340	Expiration Date Dec. 31, 2003
Receipt Number 188902	Signature

DEPARTMENT OF NATURAL RESOURCES  
WATER WELL DRILLING LICENSE

Division of Water

Larry W. Erdman

is entitled to operate well drilling equipment or engage in  
the drilling of wells Pursuant to I.C. 25-39.

Certificate Number 1338	Expiration Date Dec. 31, 2002
Receipt Number 190593	Signature

DEPARTMENT OF NATURAL RESOURCES  
WATER WELL DRILLING LICENSE

Division of Water

Larry W. Erdman

is entitled to operate well drilling equipment or engage in  
the drilling of wells Pursuant to I.C. 25-39.

Certificate Number 1338	Expiration Date Dec. 31, 2003
Receipt Number 188902	Signature



JOHNSON SCREENS  
P.O. BOX 64118  
ST. PAUL, MN 55164

TELEPHONE 651-636-3900  
FACSIMILE 651-638-3132

August 15, 2001

### MATERIAL CERTIFICATE OF COMPLIANCE

Global Drilling Suppliers Inc.  
12101 Centron Place  
Cincinnati, OH 45240-1704

Customer's Purchase Order or Contract No.: 3004862

U.S. Filter/Johnson Screens Sales Order No.: 113367-SO

Work Order Number: 2315621, 2315647, 2315655, 2315663, 2315639

Parent Item: SDSENV - SS V-Wire Screen, SS Casing, and SS Plug

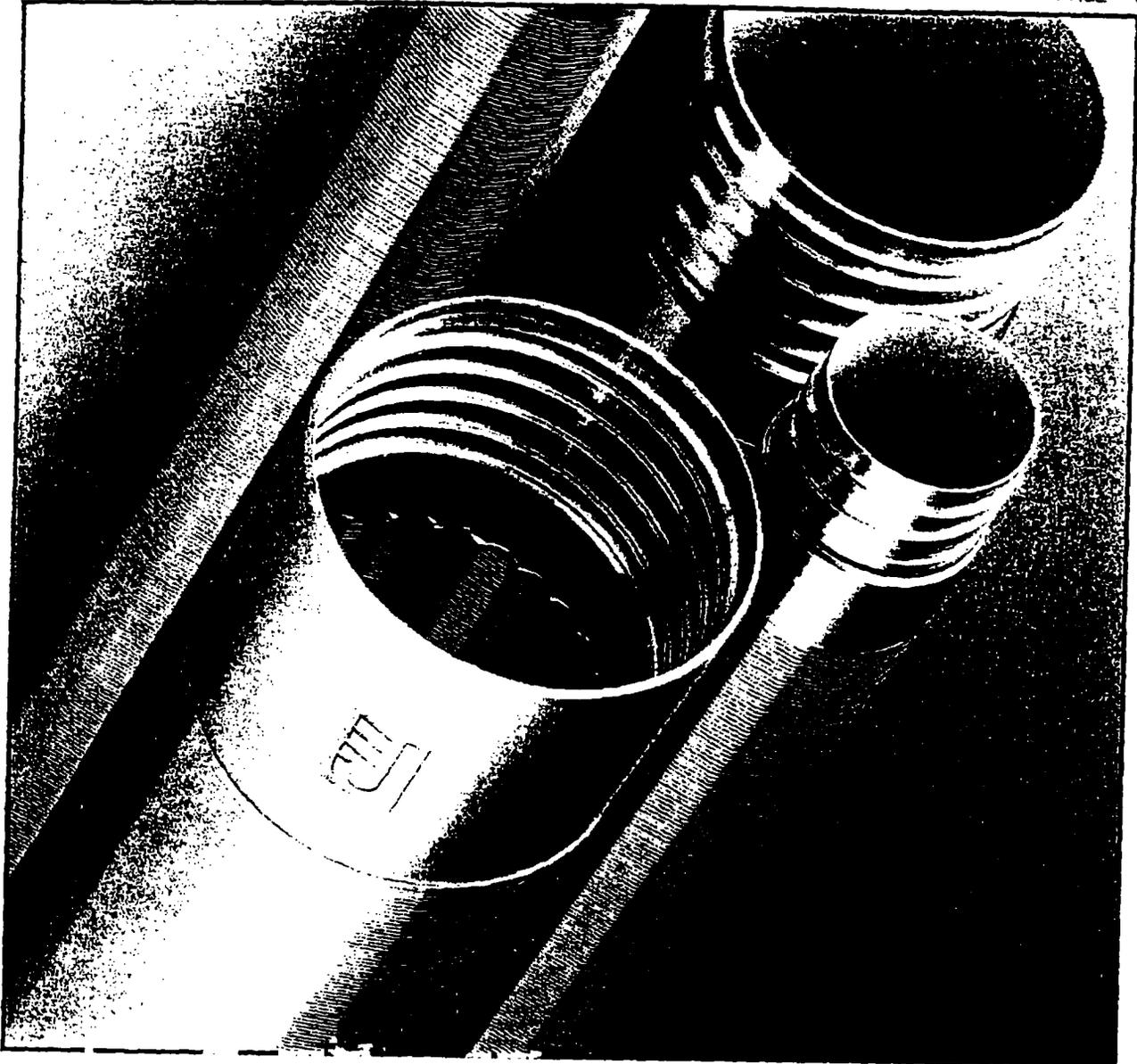
Drawing Number: N/A

Material: 304

State of Indiana Specification: Code 312-IAC-13-8-3

U.S. Filter/Johnson Screens hereby certifies that all material and/or processes used in the manufacture of the above part numbers conforms to material and/or manufacturing specifications detailed on U.S. Filter/Johnson Screens drawings and/or other specifications listed above and are in accordance with the manufacturing provisions of the order. Stock components may have been used to assemble the products on this order; therefore, material traceability of each component may not be available.

By: *Dennis C. Fretter*  
Authorized Representative  
U.S. Filter/Johnson Screens



**Choose Johnson screens™ Stainless Steel Products for High Strength, Sample Integrity and Long Life**

- Use Johnson screens™ stainless steel products especially when organic contaminants are present.
- Straight and square joints with precise threads minimize make-up time. Reduce the chance of cross-threading and poor alignment.
- All threads comply with ASTM F480 standards. Fully compatible with all Johnson screens™ PVC products for greater convenience and performance for hybrid wells.

- Viton O-rings seal tightly for leak-proof screen and casing joints to reduce chance of cross contamination.
- Flush joints without any ledges mean sampling devices won't catch inside. Filter pack won't bridge outside.
- For monitoring applications, all stainless steel products are cleaned to remove grease, oils and other substances which could alter a sample's chemistry and are individually wrapped and heat-sealed for sanitary protection during shipment and storage.



Post-it® Fax Note	7671	Date	09/27/02	# of pages	10
To	Bill	From	Bria Walker		
Co./Dept.	Bart-Langley Co.	Co.	GDS		
Phone #	317-784-1838	Phone #	800-356-6400		
Fax #	317-784-2035	Fax #	513-671-8705		

### STAINLESS STEEL VEE-WIRE® SCREENS FOR MONITORING WELLS

Pipe Size (Inches)	DIAMETER		Shipping Wt. (Lb./Ft.)	OPEN AREA (Sq. In./Ft.)			STRENGTH		
	O.D. (Inches)	I.D. (clear) (Inches)		6-Slot	10-Slot	20-Slot	Collapse <sup>2</sup> (PSI)	Tensile <sup>2</sup> (Lbs.)	Hanging <sup>4</sup> Wt. (Lbs.)
1-1/4	1.71	1.23	1.7	6.4	9.2	16.1	2,500	5,400	1,000
1-1/2	1.96	1.50	1.9	7.3	10.5	18.4	1,500	5,400	1,000
2	2.46	2.00	2.2	9.2	13.2	23.1	1,100	5,400	1,000
4	4.55	4.00	4.2	17.0	24.4	42.7	195	13,000	2,400
6	6.63	5.90	8.0	22.7	35.7	62.5	93	19,250	3,500

### STAINLESS STEEL VEE-WIRE® SCREENS FOR REMEDIATION OR RECOVERY WELLS

Pipe Size (Inches)	DIAMETER		Shipping Wt. (Lb./Ft.)	OPEN AREA (Sq. In./Ft.)			STRENGTH		
	O.D. (Inches)	I.D. (clear) (Inches)		6-Slot	10-Slot	20-Slot	Collapse <sup>2</sup> (PSI)	Tensile <sup>2</sup> (Lbs.)	Hanging <sup>4</sup> Wt. (Lbs.)
6	6.63	5.9	8	22.7	35.7	62.5	93	19,250	3,500
8	8.7	7.8	12	24.1	38.4	68.6	69	60,000	12,000
10	10.8	9.9	17	25.4	40.7	73.9	65	77,000	15,400
12	12.8	11.8	25	24.8	38.1	70.5	95	88,000	17,600
14	14.0	13.0	27	25.8	41.7	77.3	72	97,000	19,400
16	16.0	14.0	30	23.3	37.9	71.4	74	109,500	21,900
18	18.0	16.0	33	25.9	42.0	79.1	53	112,500	22,500
20	20.0	18.0	44	28.8	46.8	88.2	39	123,000	24,600
24	24.0	22.0	50	40.0	64.7	120.7	34	123,000	24,600

- Specifications above are for 304 stainless steel. Also available in galvanized, low carbon steel, 316L stainless steel and other nickel alloy materials.
  - Information is based on maximum well depths of 250 feet. Diameters up to 36" PS are available.
  - Standard fittings are ASTM F480 flush threads for 8" PS or smaller diameters. Other fittings available are weld rings, NPT threads, plate bottoms or points (2" and 4" only).
  - Other designs, such as passivated, electropolished or enhanced open area screens are available in most sizes through 16" PS.
1. Clear IDs are dimensions after welding of Sch40 F480 flush threads or other fittings.
  2. Collapse strengths are calculated for a 20-slot screen.
  3. Tensile strengths (ultimate) are based on the total area of the screen support rods.
  4. Hanging weights are the maximum combined weight of riser and screen to be hung from the top screen joint.

### STAINLESS STEEL RISER PIPES

Pipe Size (Inches)	DIAMETER		Shipping Wt. (Lb./Ft.)	STRENGTH			
	O.D. (Inches)	I.D. (clear) (Inches)		Collapse (PSI)	Tensile <sup>2</sup> (Lbs.)	Column <sup>3</sup> (Lbs.)	Hanging <sup>4</sup> Wt. (Lbs.)
1-1/4	1.66	1.27	1.2	1,725	9,400	450	1,800
1-1/2	1.90	1.50	1.4	1,376	11,700	675	2,300
2	2.38	2.06	1.7	896	16,600	1,350	3,300
4	4.50	4.02	4.0	315	41,800	12,000	8,300
6	6.63	6.06	7.7	129	38,500	39,600	7,700
8	8.63	7.98	10.0	62	36,000	52,000	7,200

- Specifications are for Sch5 risers in 304 stainless steel ASTM type A312 or A778 material. Also available in Sch10 and 40; and in low carbon steel, 316 stainless steel and other materials. Standard fittings are F480 flush threads. Weld rings, NPT threads, and plate bottoms are available. 2" and 4" sizes are stocked in several lengths.
1. IDs are the clear dimensions through the flush thread fittings.
  2. Tensile strengths are based on the joint tensile strength of 304 stainless steel F480 flush threads.
  3. Column strengths are the axial load for buckling or compression failure based on a 20' span hinged at both ends.
  4. Hanging weights are the maximum recommended weight of riser and screen hung as one string in a well.



Chicago Tube and Iron Company

STAINLESS

**WELDED STAINLESS PIPE – Continued**  
**ASTM/ASME SA-312**

**SCHEDULE 40**

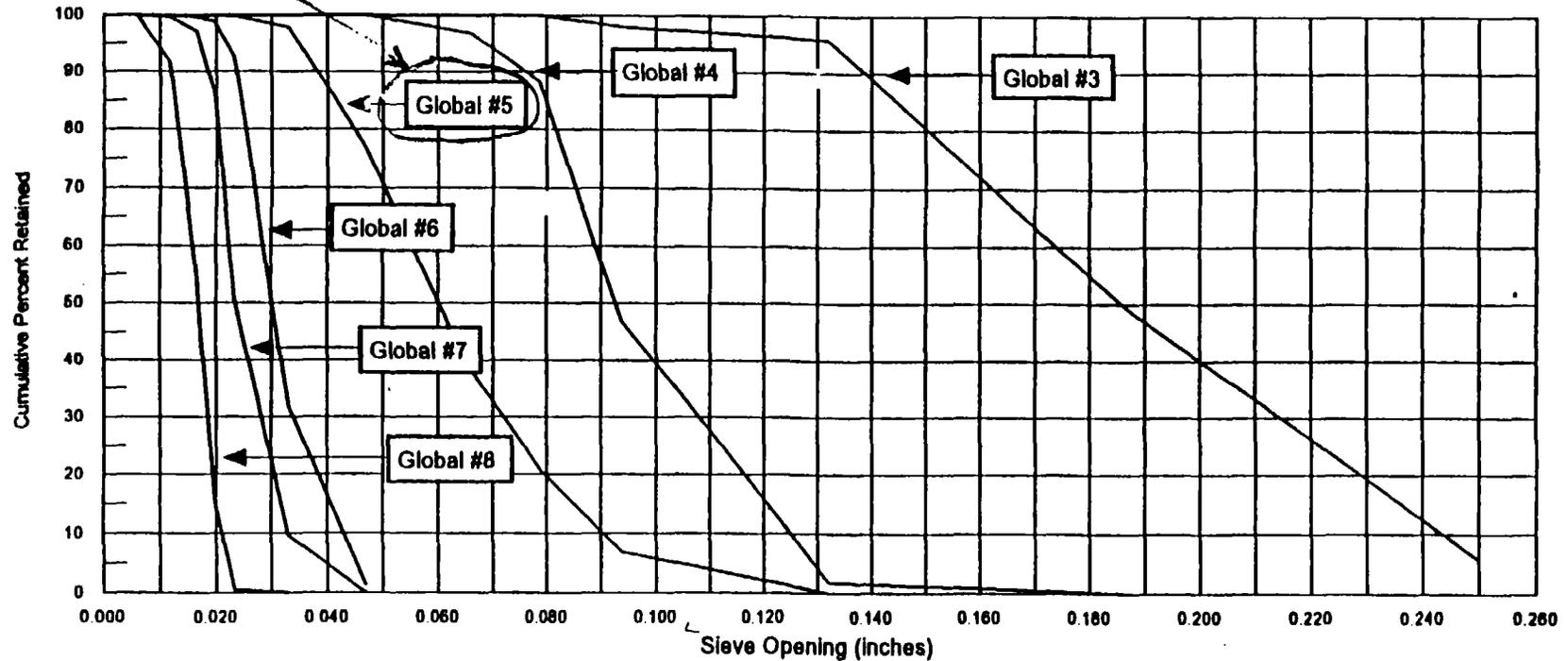
Pipe Size Inches	Dimensions (Inches)		Wall Thickness Inches	Weight Pc. Lbs	Type 304	Type 304L	Type 316	Type 316L
	OD	ID						
1/8	0.405	0.289	0.068	0.244	X	X	X	X
1/4	0.540	0.364	0.088	0.424	X	X	X	X
3/8	0.675	0.493	0.091	0.567	X	X	X	X
1/2	0.840	0.622	0.109	0.851	X	X	X	X
3/4	1.050	0.824	0.113	1.131	X	X	X	X
1	1.315	1.049	0.133	1.679	X	X	X	X
1-1/4	1.660	1.380	0.140	2.273	X	X	X	X
1-1/2	1.900	1.610	0.145	2.718	X	X	X	X
2	2.375	2.067	0.154	3.653	X	X	X	X
2-1/2	2.875	2.489	0.203	5.793	X	X	X	X
3	3.500	3.068	0.216	7.576	X	X	X	X
3-1/2	4.000	3.548	0.226	9.109	X	X	X	X
4	4.500	4.026	0.237	10.790	X	X	X	X
5	5.563	5.047	0.258	14.620	X	X	X	X
6	6.625	6.065	0.280	18.970	X	X	X	X
8	8.625	7.981	0.322	28.550	X	X	X	X
10	10.750	10.010	0.365	40.480	X	X	X	X
12	12.750	12.000	0.375	49.560	X	X	X	X
14	14.000	13.250	0.375	54.570		X		X
16	16.000	15.250	0.375	62.580		X		X
18	18.000	17.250	0.375	70.590		X		X
20	20.000	19.250	0.375	78.600		X		X
24	24.000	23.250	0.375	94.620		X		X

**SCHEDULE 80**

1/8	0.405	0.215	0.095	0.314	X	X	X	X
1/4	0.540	0.302	0.119	0.535	X	X	X	X
3/8	0.675	0.423	0.126	0.738	X	X	X	X
1/2	0.840	0.546	0.147	1.088	X	X	X	X
3/4	1.050	0.742	0.154	1.474	X	X	X	X
1	1.315	0.957	0.179	2.172	X	X	X	X
1-1/4	1.660	1.278	0.191	2.997	X	X	X	X
1-1/2	1.900	1.500	0.200	3.631	X	X	X	X
2	2.375	1.939	0.218	5.022	X	X	X	X

# GLOBAL QUARTZ SILICA FILTER PACK

Sieve Analysis by Best Sand, Jan., 1998



**GLOBAL DRILLING SUPPLIERS, INC.**  
12101 Centron Place  
Cincinnati, Ohio 45246 USA  
TEL: 513-671-8700 / FAX: 513-671-8705  
<http://www.globaldrillsup.com>

**Global Quartz Silica Filter Sand:**  
NSF - approved  
Washed & dried; will not freeze up.  
EZ-carry 50 lb plastic bags  
Bulk tonnage available

99% pure silica  
Uniformity Coeff. less than 1.70  
Each 50 lb bag = approx. 0.5 cu. ft.

revised 1-98

# Best Sand Corporation

Global #5

## Product Analysis Report

1/25/99



**Sieve Analysis:**

<u>Sieve Size</u>	<u>% Retained</u>	<u>% Cumulative</u>	<u>% Passing</u>
6 Mesh	0.1	0.1	99.9
8 Mesh	7.0	7.1	92.9
10 Mesh	13.6	20.7	79.3
12 Mesh	15.4	36.1	63.9
16 Mesh	40.5	76.6	23.4
20 Mesh	21.0	97.6	2.4
30 Mesh	2.1	99.7	0.3
40 Mesh	0.2	99.9	0.1
50 Mesh	0.0	99.9	0.1
100 Mesh	0.0	99.9	0.1
Pan	0.0	99.9	0.1
E.S.		0.99	
U.C.		1.57	

**Customer:** Current Product Average

I certify that this load conforms to the above specifications:

*W. Nevison*



# FAIRMOUNT MINERALS

BEST SAND • BESTONE • FAIRMOUNT ABRASIVES • GARICK • MOBILE ABRASIVES • SANTRON • STAN BLAST  
TECHNISAND • WEDRON SILICA • WEXFORD SAND • WISCONSIN INDUSTRIAL SAND

P.O. BOX 177 • WEDRON, IL 60557  
800/281-9876

## MATERIAL SAFETY DATA SHEET

Date: November 17, 2000

Supersedes: August 1, 1999

### I. PRODUCT IDENTIFICATION

Trade Name as Labeled: Silica or Lake Sand; all grades

Chemical Name and Formula: Silica, mainly in the form of quartz; SiO<sub>2</sub>

### II. HAZARDOUS INGREDIENTS

CAS Number: 14808-60-7

Chemical Name: Quartz

Percent: >90

ACGIH-TLV: 0.1 mg/m<sup>3</sup>

OSHA-PEL: 10 mg/m<sup>3</sup>

% SiO<sub>2</sub> + 2

(Exposure limits are for  
respirable fraction.)

NIOSH recommends a Permissible Exposure Limit (PEL) of 0.05 mg/m<sup>3</sup> respirable free silica. ACGIH-TLV and OSHA PEL are not interchangeable limit values.

### III. PHYSICAL PROPERTIES

Vapor Density: Not applicable.

Specific Gravity: 2.65

Solubility in Water: Insoluble.

Vapor Pressure: 10mm @ 1730°C

Melting Point: 1710°C

Boiling Point: 2230°C

Evaporation Rate: None.

Appearance and Color: White to tan; odorless.

### IV. FIRE AND EXPLOSION

Flash Point: Does not flash.

Flammable Limits in Air: None

Unusual Fire Fighting Procedures: None.

Unusual Fire and Explosion Hazards: None.

Auto-ignition Temperature: None.

Fire Extinguishing Materials: Non-combustible. May be used to extinguish fires.

### V. HEALTH HAZARD INFORMATION

Symptoms of Overexposure:

Inhaled: Shortness of breath, coughing, reduced pulmonary function. **PROLONGED INHALATION OF RESPIRABLE SILICA WILL RESULT IN PERMANENT LUNG DAMAGE, SILICOSIS.**

Contact with Eyes or Skin: Eye irritation.

Swallowed: May cause gastrointestinal discomfort. Give one or two glasses of water. If discomfort persists, see a physician.

First Aid: Emergency procedures.

Eye Contact: Wash with water for at least fifteen (15) minutes. If irritation or redness persists see a physician.

**Skin Contact:** Wash with soap and water. If irritation persists see a physician.

**Inhaled:** Remove to fresh air at once. Apply artificial respiration if having breathing difficulties.

**Suspected Cancer Agent:** Yes. **Federal OSHA:** No **NTP:** Yes **IARC:** Yes

**NTP:** Respirable crystalline silica has been listed in the Sixth Annual Report on Carcinogens.

**IARC:** Monographs on the Evaluation of the Carcinogenic Risk of Chemical to Humans (vol. 68, 1997) concludes that there is sufficient evidence in humans for the carcinogenicity of inhaled crystalline silica in the forms of quartz and cristobalite (Group 1) in certain industrial circumstances, but that carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs.

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## VI. REACTIVITY DATA

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**Stability:** Stable.

**Incompatibility (materials to avoid):** ClF<sub>3</sub>, MnF<sub>3</sub>, OF<sub>2</sub>

**Hazardous Polymerization:** Will not occur.

**Hazardous Decomposition Products:** None.

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## VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

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**Spill Response Procedures (including employee protection measures):** Clean up using approved, dustless methods (water or vacuum) to minimize generation of respirable silica particles.

**Waste Disposal:** Dispose of in a facility approved for silica.

---

## VIII. SPECIAL HANDLING INFORMATION

---

**Ventilation and Engineering Controls:** Local mechanical to reduce respirable silica to below safe levels.

**Respiratory Protection (Type):** Use NIOSH approved equipment. Positive pressure supplied air-type recommended. Appropriate respiratory protection for respirable particulates is based on consideration of airborne workplace concentrations and duration of exposure arising from the intended end use. Please refer to the most recent standards of ANSI (Z88.2), OSHA (29CFR 1910.134), MSHA (30 CFR Parts 56 & 57), and NIOSH RDL. If you are unsure as to the type of respirator to be used please consult your employer.

**Eye Protection (Type):** Safety glasses.

**Gloves (Specify Material):** Not normally required.

**Other Protective Clothing and Equipment:** Not normally required.

**Work Practices, Hygienic Practices:** Clean up spills promptly. Do not engage in activities that will generate respirable silica particles.

**Other Handling and Storage Requirements:** Avoid generating dust. No special storage requirements. Train all exposed persons in all sections of this MSDS and the proper handling of silica before they work with this product.

See OSHA Hazard Communication Rule CFR 1910.1200, 1915.99, 1917.28 and 1928.21, state, local worker, or community "Right to Know" laws and regulations. We recommend that smoking be prohibited in all areas where respirators must be used. Warn your employees (and your customer users in case of resale) by posting and other means of the hazard and OSHA precautions to be used. Provide training about the OSHA precautions.

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## IX. OTHER INFORMATION

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**H.M.L.S. Rating:**

Health Hazard Rating 1\*

Flammability Hazard Rating 0

Reactivity Hazard Rating 0

Personal Protective Equipment E\*\*

**D.O.T.:** Not regulated.

**SARA Title III:** Not listed.

\*Chronic exposure to respirable size silica will result in silicosis. \*\*Comply with special OSHA respiratory protection if sandblasting.

## TECHNICAL DATA SHEET

# PureGold® Grout

NSF.

- Description:** PureGold Grout is an easy mixing, single component, organic free, high solids bentonite clay grout. It was engineered to form a contaminant resistant seal without effecting groundwater chemistry. PureGold Grout is a technically superior replacement for traditional cement grouts.
- Recommended Use:** PureGold Grout should be used in sealing of the annular space of monitoring wells to control contaminate infiltration and preserve ambient groundwater quality.
- Characteristics:**
- Contaminant free. All 116 priority pollutants tested for were below CLP detection limits
  - Chemically stable. Results from TCLP Metals Analysis are below RCRA limits for hazardous constituents
  - pH range from 5-6 standard units
  - Low permeability, laboratory test results range from  $1 \times 10^{-7}$  to  $1 \times 10^{-9}$  cm/sec
  - Generates no heat during mixing or curing and will not damage well casing
  - Remains flexible, maintains putty-like consistency over time and will rehydrate.
- Mixing and Application:** PureGold Grout should be mixed with a paddle mixer or a mud rotary recirculation system and pumped with a positive displacement pump. It can be mixed in a slurry up to 30% solids. PureGold Grout remains placeable for up to two hours and sets in eight hours.
- To achieve a 30% solids slurry, add one 50 lb. bag of grout 14 gals. of fresh water. This ratio will yield approximately 2.2 cu. ft.
- Bulk Density:** 75.55 lbs./ft.<sup>3</sup> when mixed with water to a 30% solids grout.
- Packaging:** 50 lb. multiwall, waterresistant bags, 48 bags per pallet. All pallets are shrinkwrapped.

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The information and data contained herein are believed to be accurate and reliable. CETCO makes no warranty of any kind and accepts no responsibility for the results obtained through application of this information.



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MATERIAL SAFETY DATA SHEET May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.120  
Standard must be consulted for specific requirements.

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PRODUCT NAME: PUREGOLD GROUT

Section I MANUFACTURER'S INFORMATION

MANUFACTURER'S NAME AND ADDRESS:

CETCO - *Drilling Products Group*  
1500 West Shure Drive  
Arlington Heights, Illinois 60004

Telephone Number: 847-392-5800 / E-mail: [www.cetco.com](http://www.cetco.com)  
Emergency Contact CHEMTREC: 800-424-9300  
Date Prepared: March 30, 1999

Section II HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

HAZARDOUS COMPONENTS:

(Specific Chemical Identity: Common Names(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Crystalline Quartz: CAS# 14808-60-7			*	< 6%
Respirable Crystalline Quartz:			NIOSH	< 2%
Present (TWA)	0.1 mg/m <sup>3</sup>	0.1 mg/m <sup>3</sup>	50 ug/m <sup>3</sup>	
Proposed (TWA)		50.0 ug/m <sup>3</sup>		
Nuisance Dust:				
Respirable	5 mg/m <sup>3</sup>	5 mg/m <sup>3</sup>		
Total Dust	15 mg/m <sup>3</sup>	10 mg/m <sup>3</sup>		

\* WARNING: This product contains a small amount of crystalline silica, which may cause delayed respiratory disease if inhaled over a prolonged period of time. Avoid breathing dust. Use NIOSH/MSHA approved respirator where TLV for crystalline silic (Quartz) may be exceeded. IARC Monographs on the evaluation of the Carcinogenic Risk of Chemicals to Humans (volume 61, 1997) concludes that crystalline silica is carcinogenic to humans in the form of quartz. IARC classification 1.

The small quantities of crystalline silica (quartz) found in this product are, under normal conditions, naturally coated with a unremovable layer of amorphous silica and/or bentonite clay. IARC (vol. 68, 1997, pg. 191-192) has stated that crystalline silic (quartz) can differ in toxicity depending on the minerals with which it is combined, citing studies in IARC (vol. 42, 1987, p. 86) which stated that the toxic effect of crystalline silica (quartz) is reduced by the "protective effect...due mainly to clay minerals..."

National Institute for Occupational Safety and Health (NIOSH) has recommended that the permissible exposure limit be change to 50 micrograms respirable free silica per cubic meter of air (0.05 mg/ m<sup>3</sup> ) as determined by a full shift sample up to a 10 hour working day, 40 hours per week. See: 1974 NIOSH criteria for a recommended Standard for Occupational Exposure to Crystalline Silica should be consulted for more detailed information.

PEL - OSHA Permissible Exposure Limit.

TLV - American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value.

TWA - 8 hour time weighted average

Note: The Permissible Exposure Limits (PEL) reported above are the pre - 1989 limits that were reinstated by OSHA June 30, 199 following a decision by the United States Circuit Court of Appeals for the 11th Circuit. Federal OSHA is now enforcing these PEL: More restrictive exposure limits may be enforced by some other jurisdictions.





PRODUCT NAME: PUREGOLD GROUT

Section II HAZARDOUS INGREDIENTS/IDENTITY INFORMATION CONT.

PRODUCT IDENTIFICATION:

Chemical Name: Dry Mixture of Inorganic Mineral Compounds.

NFPA/HMIS: Health - 2, Fire - 0, Reactivity - 0, Specific Hazard - See Section VI.

Shipping Class: Not Regulated (DOT / 49CFR, IMDG, ICAO / IATA).

Section III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point:	Not Applicable.	Specific Gravity (H <sub>2</sub> O = 1):	2.5
Vapor Pressure (mm Hg.):	Not Applicable.	Melting Point:	1400°F
Vapor Density (AIR = 1):	Not Applicable.	Evaporation Rate (Butyl Acetate = 1):	Not Applicable.
Solubility in Water:	Negligible.		
Appearance and Odor:	Tan or beige to light gray colored powder to fine granules, odorless.		

Section IV FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used):	Not Available.		
Flammable Limits:	Not Available.	LEL - NA.	UEL - NA.
Extinguishing Media:	Not Applicable.		
Special Fire Fighting Procedure:	Not Applicable.		
Unusual Fire/Explosion Hazards:	Product may pose possible dust explosion under <u>extremely rare</u> circumstances or conditions.		

Section V REACTIVITY DATA

Stability:	Unstable -	Conditions to Avoid - None Known.
	Stable - X	

Incompatibility (Materials to Avoid): Powerful oxidizing agents such as fluorine, chlorine trifluoride, manganese trioxide, etc.

Hazardous Decomposition or By-products: Silica will dissolve in hydrofluoric acid producing a corrosive gas, silicon tetrafluoride.

Hazardous Polymerization:	May Occur -	Conditions to Avoid - None Known.
	Will Not Occur - X	





PRODUCT NAME: PUREGOLD GROUT

Section VI HEALTH HAZARD DATA

Route(s) of Entry: Inhalation? Yes Skin? No Ingestion? No

Health Hazards (Acute and Chronic):

**Inhalation:** Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may have the following serious chronic health effects:

**Silicosis:** Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness and reduce pulmonary function. Smoking exacerbates this disease. Individuals with silicosis are predisposed to develop tuberculosis.

**Cancer Status:** The International Agency for Research on Cancer has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1 - carcinogenic to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibers (published in June 1997) in conjunction with the use of these materials. The National Toxicology Program classifies respirable crystalline silica as "reasonably anticipated to be a carcinogen". For further information See: "Adverse effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, page 761-765, 1997.

**Other Data with Possible Relevance to Human Health:** The small quantities of crystalline silica (quartz) found in this product are under normal conditions, naturally coated with an unremovable layer of amorphous silica and/or bentonite clay. IARC (Vol. 68 1997, pg. 191-192) has stated that crystalline silica (quartz) can differ in toxicity depending on the minerals with which it is combined, citing studies in IARC (Vol. 42, 1987 pg. 86) which stated that the toxic effect of crystalline silica (quartz) is reduced by the "protective effect....due mainly to clay minerals...."

Carcinogenicity: NTP? No IARC Monographs? Yes OSHA Regulated? No

**Signs and Symptoms of Exposure:** Excessive inhalation of generated dust may result in shortness of breath and reduced pulmonary function.

**Medical Conditions Generally Aggravated by Exposure:** Individuals with respiratory disease, including but not limited to, asthma and bronchitis, or subject to eye irritation should not be exposed to respirable crystalline silica (quartz) dust.

Emergency and First Aid Procedures:

- Eyes & Skin: Flush with water.
- Gross Inhalation of Dust: Remove to fresh air; give oxygen or artificial respiration if necessary; seek medical attention.
- Ingestion: If large amounts are swallowed, get immediate medical attention.

Section VII PRECAUTIONS FOR SAFE HANDLING AND USE

**Steps to be Taken in Case Material is Released or Spilled:** Vacuum if possible to avoid generating airborne dust. Avoid breathing dust. Wear an approved respirator. Avoid adding water; product will become slippery when wet.

**Waste Disposal Method:** Bury in an approved sanitary landfill, in accordance with federal, state and local regulations.

**Precautions to Be Taken in Handling and Storing:** Avoid breathing dust, use NIOSH/MSHA approved respirator where TLV limits for Crystalline Silica may be exceeded.

**Other Precautions:** Slippery when wet.



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**PRODUCT NAME: PUREGOLD GROUT**

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**Section VIII CONTROL MEASURES**

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**Respiratory Protection:** Use appropriate respiratory protection for respirable particulate based on consideration of airborne workplace concentration and duration of exposure arising from intended end use. Refer to the most recent standards of ANSI (z88.2) OSHA (29 CFR 1910.134), MSHA (30 CFR Parts 56 and 57) and NIOSH Respirator Decision Logic.

**Ventilation:** Use local exhaust as required to maintain exposures below applicable occupational exposure limits (*See Section II*). See also ACGIH "Industrial Ventilation – A Manual for Recommend Practice", (*current edition*).

**Protective Gloves:** Not Required.

**Eye Protection:** Recommended.

**Other Protective Clothing or Equipment:** None.

**Work/Hygienic Practices:** Use good housekeeping practices.

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**Section IX REGULATORY INFORMATION**

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**SARA 311/312:** Hazard Categories for SARA Section 311/312 Reporting: Chronic Health

**SARA 313:** This product contains the following chemicals subject to annual release reporting requirements under the SARA section 313 (40 CFR 372): None

**CERCLA section 103 Reportable Quantity:** None

**California Proposition 65:** *This product contains the following substances known to the state of California to cause cancer and/or reproductive harm: This product contains crystalline silica (respirable); however, the user should note that the small quantities of crystalline silica (quartz) found in this product are, under normal conditions, naturally coated with an unremovable layer of amorphous silica and/or bentonite clay. IARC (Vol. 68, 1997, pg. 191-192) has stated that crystalline silica (quartz) can differ in toxicity depending on the minerals with which it is combined. Citing studies in IARC (Vol. 42, 1987, p. 86) which stated that the toxic effect of crystalline silica (quartz) is reduced by the "protective effect....due mainly to clay minerals..."*

**Toxic Substances Control Act:** All of the components of this product are listed on the EPA TSCA Inventory or are exempt from notification requirements.

**Canadian Environmental Protection Act:** All the components of this product are listed on the Canadian Domestic Substances List or exempt from notification requirements.

**European Inventory of Commercial Chemical Substances:** All the components of this product are listed on the EINECS Inventory or exempt from notification requirements. (The EINECS number for Quartz: 231-545-5)

**European Community Labeling Classification:** Harmful (Xn)

**European Community Risk and Safety Phrases:** R40, R48, S22

**Japan MITI:** All the components of this product are existing chemical substances as defined in the Chemical Substance Control Law.

**Australian Inventory of Chemical Substances:** All the components of this product are listed on the AICS Inventory or exempt from notification requirements.

**Canadian WHMIS Classification:** Class D, Division 2, Subdivision A (Very Toxic Material causing other Toxic Effects)

**F-+PA Hazard Rating:** Health: 2 Fire: 0 Reactivity: 0

**HMIS Hazard Rating:** Health: \* Fire: 0 Reactivity: 0

\*Warning - Chronic health effect possible - inhalation of silica dust may cause lung injury/disease (silicosis). Take appropriate measures to avoid breathing dust. *See Section II.*





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PRODUCT NAME: PUREGOLD GROUT

Section IX REGULATORY INFORMATION CONT.

REFERENCES: Registry for Toxic Effects of Chemical Substances (RTECS), 1995.  
Patty's Industrial Hygiene and Toxicology.  
NTP Seventh Annual Report on Carcinogens, 1994.  
IARC Monograph Volume 68, Silica, Some Silicates and Organic Fibers, 1997.

The information herein has been compiled from sources believed to be reliable and is accurate to the best of our knowledge. However, CETCO cannot give any guarantees regarding information from other sources, and expressly does not make any warranties, nor assumes any liability, for its use.



## TECHNICAL DATA SHEET

# PureGold® Medium Chips

NSF.

**Description:** PureGold Chips are natural sodium bentonite screened to 1/4" to 3/8" in size.

**Recommended Use:** For sealing shallow boreholes, decommissioning wells, providing an interface between bentonite grouts and cement and as a backfill for grounding rod installations.

**Characteristics:**

- Chemically stable - results from TCLP Metals Analysis are below RCRA limits for hazardous constituents
- Provides a high solids clay seal
- Prevents infiltration of surface contamination
- Provides a permanent flexible seal
- Can be used to seal abandoned boreholes, conductor pipe and seismic shot holes
- Forms a low resistivity contact to grounding rods

**Mixing and Application:** Bagged material should be screened of fines before placement. Pour PureGold Chips slowly down hole to prevent bridging or binding in the unsaturated zone, water should be added at two foot intervals to assure adequate hydration.

### Application Matrix

Hole Dia. (In.)	2	4	6	8	10	12	14
Approximate Lbs. Chips/Linear Foot	2	6	14	25	38	55	75

**Bulk Density:** 69.25 lbs./ft<sup>3</sup>

**Packaging:** 50 lb. multi-wall, water-resistant bags, 48 bags per pallet. All pallets are shrinkwrapped.



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MATERIAL SAFETY DATA SHEET May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

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Page 1 of 5

PRODUCT NAME: PUREGOLD MEDIUM CHIPS

Section I MANUFACTURER'S INFORMATION

MANUFACTURER'S NAME & ADDRESS:

CETCO - Drilling Products Group  
1350 West Shure Drive  
Arlington Heights, IL 60004

Telephone Number: 847-392-5800 E-mail: www.cetco.com  
EMERGENCY CONTACT: CHEMTREC 800-424-9300  
Date Prepared: February 23, 1999

Section II HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

HAZARDOUS COMPONENTS: (Specific Chemical Identity: Common Names(s))	CAS#	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Crystalline Quartz	14808-60-7			*	< 6%
Respirable Crystalline Quartz				NIOSH	< 2%
Present (TWA)		0.1 mg/m <sup>3</sup>	0.1 mg/m <sup>3</sup>	50 ug/m <sup>3</sup>	
Proposed (TWA)			50.0 ug/m <sup>3</sup>		
Nuisance Dust:					
Respirable		5 mg/m <sup>3</sup>	5 mg/m <sup>3</sup>		
Total Dust		15 mg/m <sup>3</sup>	10 mg/m <sup>3</sup>		

\* WARNING: This product contains a small amount of crystalline silica, which may cause delayed respiratory disease if inhaled over a prolonged period of time. Avoid breathing dust. Use NIOSH/MSHA approved respirator where TLV for crystalline silica (Quartz) may be exceeded. IARC Monographs on the evaluation of the Carcinogenic Risk of Chemicals to Humans (volume 68, 1997) concludes that crystalline silica is carcinogenic to humans in the form of quartz. IARC classification 1.

The small quantities of crystalline silica (quartz) found in this product are, under normal conditions, naturally coated with an unremovable layer of amorphous silica and/or bentonite clay. IARC (vol. 68, 1997, pg. 191-192) has stated that crystalline silica (quartz) can differ in toxicity depending on the minerals with which it is combined, citing studies in IARC (vol. 42, 1987, p. 86) which stated that the toxic effect of crystalline silica (quartz) is reduced by the "protective effect...due mainly to clay minerals..."

National Institute for Occupational Safety and Health (NIOSH) has recommended that the permissible exposure limit be changed to 50 micrograms respirable free silica per cubic meter of air (0.05 mg/m<sup>3</sup>) as determined by a full shift sample up to a 10 hour working day, 40 hours per week. See: 1974 NIOSH criteria for a recommended Standard for Occupational Exposure to Crystalline Silica should be consulted for more detailed information.

PEL - OSHA Permissible Exposure Limit.

TLV - American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value.

TWA - 8 hour time weighted average

Note: The Permissible Exposure Limits (PEL) reported above are the pre - 1989 limits that were reinstated by OSHA June 30, 1993 following a decision by the United States Circuit Court of Appeals for the 11th Circuit. Federal OSHA is now enforcing these PELs. More restrictive exposure limits may be enforced by some other jurisdictions.





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PRODUCT NAME: PUREGOLD MEDIUM CHIPS

Section II HAZARDOUS INGREDIENTS/IDENTITY INFORMATION CONT.

PRODUCT IDENTIFICATION:

Chemical Name: Dry Mixture of Clay Silicate Compounds.  
NFPA/HMIS: Health - 2, Fire - 0, Reactivity - 0, Specific Hazard - See Section VI  
DOT Class: Not Regulated (49 CFR / IMDG)

Section III PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point - Not Applicable Specific Gravity (H<sub>2</sub>O = 1) - 2.5  
Vapor Pressure (mm Hg.) - Not Applicable Melting Point - Not Applicable  
Vapor Density (AIR = 1) - Not Applicable Evaporation Rate (Butyl Acetate = 1) - Not Applicable  
Solubility in Water - Negligible  
Appearance and Odor - Pale gray to buff chips, odorless.

Section IV FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used) - Not Available  
Flammable Limits - Not Available LEL - NA UEL - NA  
Extinguishing Media - Not Applicable  
Special Fire Fighting Procedures - Not Applicable  
Unusual Fire/Explosion Hazards - Not Applicable

Section V REACTIVITY DATA

Stability Unstable - Conditions to Avoid - None Known  
Stable - X

Incompatibility (Materials to Avoid) - Powerful oxidizing agents such as fluorine, chlorine trifluoride, manganese trioxide, etc.

Hazardous Decomposition or By-products - Silica will dissolve in hydrofluoric acid producing a corrosive gas, silicon tetrafluoride.

Hazardous Polymerization May Occur - Conditions to Avoid - None Known  
Will Not Occur - X





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PRODUCT NAME: PUREGOLD MEDIUM CHIPS

Section VI HEALTH HAZARD DATA

Route(s) of Entry: Inhalation? Yes Skin? No Ingestion? No

Health Hazards (Acute and Chronic):

Inhalation: Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may have the following serious chronic health effects:

Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness and reduced pulmonary function. Smoking exacerbates this disease. Individuals with silicosis are predisposed to develop tuberculosis.

Cancer Status: The International Agency for Research on Cancer has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1 - carcinogenic to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibers (published in June 1997) in conjunction with the use of these materials. The National Toxicology Program classifies respirable crystalline silica as "reasonably anticipated to be a carcinogen". For further information See: "Adverse effects of Crystalline Silica Exposure" published by the American Thoracic Society Medical Section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, page 761-765, 1997.

Other Data with Possible Relevance to Human Health:

The small quantities of crystalline silica (quartz) found in this product are, under normal conditions, naturally coated with an unremovable layer of amorphous silica and/or bentonite clay. IARC (Vol. 68, 1997, pp. 191-192) has stated that crystalline silica (quartz) can differ in toxicity depending on the minerals with which it is combined, citing studies in IARC (Vol. 42, 1987 pg. 86) which stated that the toxic effect of crystalline silica (quartz) is reduced by the "protective effect....due mainly to clay minerals...".

Carcinogenicity: NTP? No IARC Monographs? Yes OSHA Regulated? No

Signs and Symptoms of Exposure:

Excessive inhalation of generated dust may result in shortness of breath and reduced pulmonary function.

Medical Conditions Generally Aggravated by Exposure:

Individuals with respiratory disease, including but not limited to, asthma and bronchitis, or subject to eye irritation should not be exposed to respirable crystalline silica (quartz) dust.

Emergency and First Aid Procedures:

Eyes & Skin: Flush with water.  
Gross Inhalation of Dust: Remove to fresh air; give oxygen or artificial respiration if necessary; seek medical attention.  
Ingestion: If large amounts are swallowed, get immediate medical attention.

Section VII PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material is Released or Spilled: Vacuum if possible to avoid generating airborne dust. Avoid breathing dust. Wear an approved respirator. Avoid adding water; product will become slippery when wet.

Waste Disposal Method: Bury in an approved sanitary landfill, in accordance with federal, state and local regulations.

Precautions to Be Taken in Handling and Storing: Avoid breathing dust, use NIOSH/MSHA approved respirator where TLV limits for Crystalline Silica may be exceeded.

Other Precautions: Slippery when wet.





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PRODUCT NAME: PUREGOLD MEDIUM CHIPS

## Section VIII CONTROL MEASURES

**Respiratory Protection:** Use appropriate respiratory protection for respirable particulate based on consideration of airborne workplace concentration and duration of exposure arising from intended end use. Refer to the most recent standards of ANSI (z88.2) OSHA (29 CFR 1910.134), MSHA (30 CFR Parts 56 and 57) and NIOSH Respirator Decision Logic.

**Ventilation:** Use local exhaust as required to maintain exposures below applicable occupational exposure limits (See Section II). See also ACGIH "Industrial Ventilation - A Manual for Recommended Practice", (current edition).

**Protective Gloves** - Not Required  
**Eye Protection** - Recommended

**Other Protective Clothing or Equipment** - None  
**Work/Hygienic Practices** - Use good housekeeping practices.

## Section IX REGULATORY INFORMATION

**SARA 311/312:** Hazard Categories for SARA Section 311/312 Reporting: Chronic Health

**SARA 313:** This product contains the following chemicals subject to annual release reporting requirements under the SARA section 313 (40 CFR 372): None

**ERCLA section 103 Reportable Quantity:** None

**California Proposition 65:** This product contains the following substances known to the state of California to cause cancer and/or reproductive harm: This product contains crystalline silica (respirable); however, the user should note that the small quantities of crystalline silica (quartz) found in this product are, under normal conditions, naturally coated with an unremovable layer of amorphous silica and/or bentonite clay. IARC (Vol. 68, 1997, pg. 191-192) has stated that crystalline silica (quartz) can differ in toxicity depending on the minerals with which it is combined. Citing studies in IARC (Vol. 42, 1987, p. 86) which stated that the toxic effect of crystalline silica (quartz) is reduced by the "protective effect....due mainly to clay minerals...".

**Toxic Substances Control Act:** All of the components of this product are listed on the EPA TSCA Inventory or are exempt from notification requirements.

**European Inventory of Commercial Chemical Substances:** All the components of this product are listed on the EINECS Inventory or exempt from notification requirements. (The EINECS number for Quartz: 231-545-5)

**Canadian Environmental Protection Act:** All the components of this product are listed on the Canadian Domestic Substances List or exempt from notification requirements.

**Japan MITI:** All the components of this product are existing chemical substances as defined in the Chemical Substance Control Law.

**Australian Inventory of Chemical Substances:** All the components of this product are listed on the AICS Inventory or exempt from notification requirements.

**Canadian WHMIS Classification:** Class D, Division 2, Subdivision A (Very Toxic Material causing other Toxic Effects)

**European Community Labeling Classification:** Harmful (Xn)

**European Community Risk and Safety Phrases:** R40, R48, S22

**NF-PA Hazard Rating:** Health: 1 Fire: 0 Reactivity: 0

**HMS Hazard Rating:** Health: \* Fire: 0 Reactivity: 0

**Warning** - Chronic health effect possible - inhalation of silica dust may cause lung injury/disease (silicosis). Take appropriate measures to avoid breathing dust. See Section II.





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**PRODUCT NAME: PUREGOLD MEDIUM CHIPS**

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**Section IX REGULATORY INFORMATION CONT.**

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**References:** Registry for Toxic Effects of Chemical Substances (RTECS), 1995  
Patty's Industrial Hygiene and Toxicology  
NTP Seventh Annual Report on Carcinogens, 1994  
IARC Monograph Volume 68, Silica, Some Silicates and Organic Fibers, 1997

The information herein has been compiled from sources believed to be reliable and is accurate to the best of our knowledge. However, CETCO cannot give any guarantees regarding information from other sources, and expressly does not make any warranties, nor assumes any liability, for its use.



**APPENDIX E**

**SYSTEM BUILDING FOUNDATION QUALITY CONTROL RESULTS**

Compressive Strength Test Results  
 For System Building Foundation Slab  
 System Building Installation  
 SBPA ISVE System

JAS  
7/1/03



**Great Lakes Soil & Environmental Consultants, Inc.**  
 333 Shore Drive, Burr Ridge, IL 60521 Ph: (630) 321-0944 Fax: (630) 321-0945

**CONCRETE CYLINDER  
 COMPRESSIVE STRENGTH TEST REPORT  
 ASTM C39-94**

<b>Project</b>	ACS Superfund Site, Griffith, IN						
<b>Client</b>	Montgomery Watson Constructors, Inc. 2775 Diehl Road, Suite 300, Warrenville, IL 60555						
<b>File No.</b>	2147	<b>Set No.</b>	2	<b>Report Print Date</b>	1/28/03	<b>Qc By</b>	SB

<b>Specifications</b>							
<b>Mix Design #</b>							
<b>Strength Spec.</b>	5000	<b>psi at</b>	28	<b>Days</b>			
<b>Slump Range From</b>	2.00	<b>to</b>	5.00	<b>inches</b>			
<b>Air Content Range From</b>		<b>to</b>		<b>%</b>			

<b>Supplier &amp; Sub Information</b>	
<b>Concrete Subcontractor</b>	
<b>Concrete Supplier</b>	

<b>Field Test Data</b>						
<b>Field Test Date:</b>	12/16/02	<b>Time Tested:</b>		<b>Field Testing By:</b>	Cont.	
<b>Location of Use:</b>						
<b>Truck No.</b>		<b>Ambient Temperature</b>		<b>°F</b>		
<b>Ticket No.</b>		<b>Concrete Temperature</b>		<b>°F</b>		
<b>Load Size, cu. Yd.</b>		<b>Final Slump</b>		<b>in.</b>		
		<b>Final Air Content</b>		<b>%</b>		

<b>Laboratory Test Data</b>							
<b>Date Received:</b>	12/20/02				<b>No. of Specimens:</b>	4	
<b>Lab Number</b>	21899	21900	21901	21902			
<b>Specimen Diameter, in</b>	6.00	6.00	6.00	6.00			
<b>Specimen Area, in<sup>2</sup></b>	28.29	28.29	28.29	28.29			
<b>Specimen Age</b>	7	14	28	28			
<b>Test Date</b>	12/23/02	12/30/02	1/13/03	1/13/03			
<b>Tested By</b>	WL	WL	WL	WL			
<b>Maximum Load, lb</b>	134950	159150	161000	161260			
<b>Actual Strength, psi</b>	4770	5630	5690	5700			
<b>Type of Failure</b>	Shear	Shear	Shear	Shear			
<b>Test Result</b>	Pass	Pass	Pass	Pass			

<b>Miscellaneous Information</b>	
<b>Equipment Serial #</b>	FORNEY 02108

<b>Remarks</b>

Field Density Test Results  
 For Aggregate Subbase  
 System Building Installation  
 SBPA ISVE System

3AD  
 3/14/02



Great Lakes Soil & Environmental Consultants, Inc.  
 333 Shore Drive, Burr Ridge, IL 60521 Ph.: (630) 321-0944 Fax: (630) 321-0945

Field Density Test Report  
 (Nuclear Density Test)

Page 1 of 1

Project: American Chemical  
 Client: MWH  
 File No. 2205  
 Date: 12-2-02  
 Type of Equipment Used for Compaction: Plate Specification: 98%

Test Number	Retest Ref. No.	Location of Test	Elevation/LIR No.	Soil Description	Probe Depth (Inches)	Wet Density (pcf)	Dry Density (pcf)	Moisture (%)	Proctor (pcf)	% Compaction	Pass/Fail
1		<u>Pad Area</u> <u>East side</u>	<u>F.G.</u>	<u>Stone Ind #53</u>	<u>BS</u>	<u>-</u>	<u>119.8</u>	<u>3.1</u>	<u>142.0</u>	<u>83.6</u>	<u>Fail</u>
2		<u>West side</u>	<u>↓</u>	<u>b</u>	<u>↓</u>	<u>-</u>	<u>129.1</u>	<u>2.8</u>	<u>b</u>	<u>90.9</u>	<u>b</u>
		<u>Pad Area Retest</u>									
3	3	<u>East side</u>	<u>F.G.</u>	<u>Stone Ind #53</u>	<u>BS</u>	<u>-</u>	<u>139.4</u>	<u>7.7</u>	<u>142.0</u>	<u>97.8</u>	<u>Pass</u>
4	4	<u>West side</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>	<u>-</u>	<u>138.7</u>	<u>7.4</u>	<u>↓</u>	<u>97.8</u>	<u>↓</u>
5	5	<u>Between Pipes</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>	<u>-</u>	<u>142.0</u>	<u>8.2</u>	<u>↓</u>	<u>100.0</u>	<u>↓</u>

Tested By: AS  
 Remarks: (note) Very little fines at surface, making hard to get a good reading even though area compacted to no yield  
Returned in afternoon after water placed and tests pass

12/13/2002 19:37  
 6303218945  
 GREAT LAKES SOIL ENV  
 PAGE 02

CAJ  
 11/14/02

12/13/2002 19:37

6303210945

GREAT LAKES SOIL ENV

PAGE 03

**Great Lakes Soil & Environmental Consultants, Inc.**  
 333 Shore Drive, Burr Ridge, IL 60527 Ph:(630) 321-0944 Fax:(630) 321-0945

**Field Density Test Report  
 (Nuclear Density Test)**

Page 1 of 1

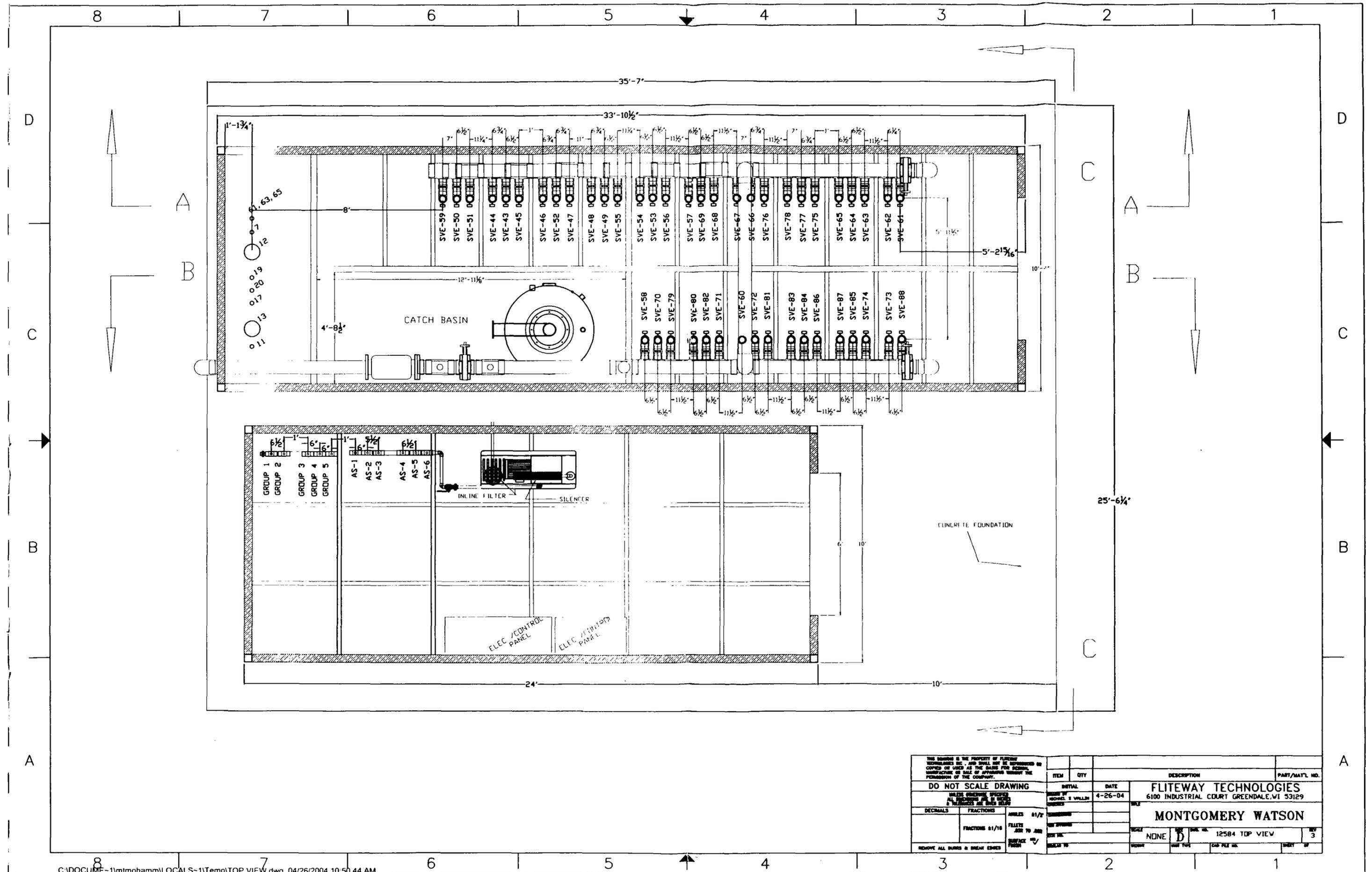
Project: American (Municipal)  
 Client: MWH  
 File No.: 2205  
 Date: 11-22-02  
 Tester: DS  
 Specification: 94% of Modified Proctor Density 94% Needed Equipment Used for Compaction: \_\_\_\_\_ Gauge Serial No.: \_\_\_\_\_

Test Number	Retest Ref. No.	Location/Description	North Coordinate or Station	East Coordinate or Offset	Elevation (ft)	Soil Description	Probe Depth (Inches)	Wet Density (pcf)	Dry Density (pcf)	Moisture (pcf)	Moisture (%)	Proctor (pcf)	% Compaction	Pass/Fail
1		<u>East Side</u>	<u>-</u>	<u>-</u>	<u>E.G.</u>	<u>Stone</u>	<u>BS</u>	<u>-</u>	<u>125.8</u>	<u>-</u>	<u>3.3</u>	<u>142.0</u>	<u>88.0</u>	<u>F</u>
2		<u>Center</u>	<u>-</u>	<u>-</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>	<u>-</u>	<u>120.8</u>	<u>-</u>	<u>3.4</u>	<u>↓</u>	<u>85.0</u>	<u>↓</u>
3		<u>West Side</u>	<u>-</u>	<u>-</u>	<u>↓</u>	<u>↓</u>	<u>↓</u>	<u>-</u>	<u>122.2</u>	<u>-</u>	<u>2.1</u>	<u>↓</u>	<u>86.0</u>	<u>↓</u>

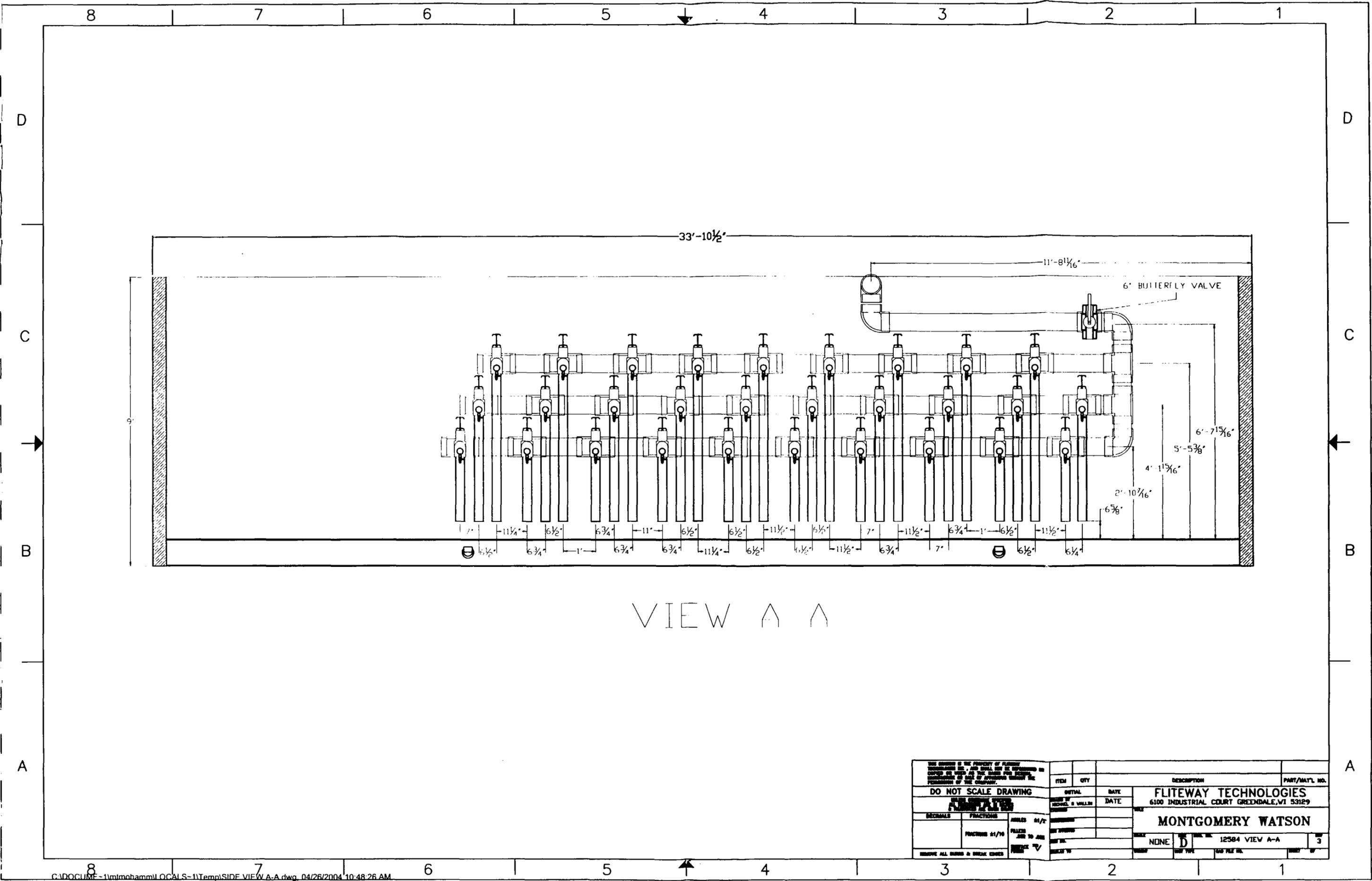
Comments: \_\_\_\_\_  
 LFT# = Lift number placed  
 F.G = Final Grade

**APPENDIX F**

**SYSTEM BUILDING AS-BUILT DRAWINGS**

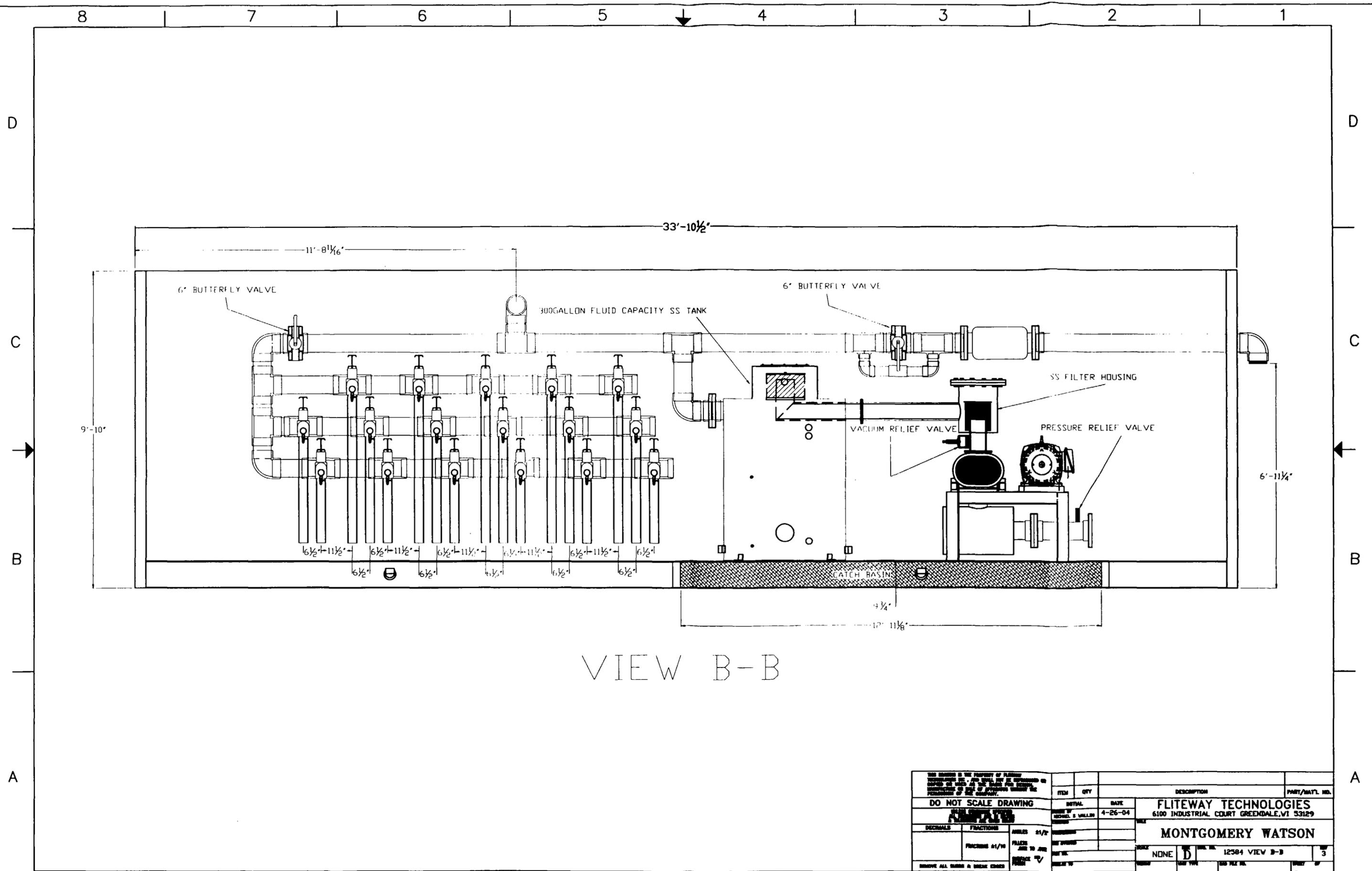


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ITEM	QTY	DESCRIPTION	PART/MAT'L NO.													
<b>DO NOT SCALE DRAWING</b> <small>UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES &amp; FRACTIONS ARE SHOWN BELOW</small>		<table border="1"> <tr> <td>INITIAL</td> <td>DATE</td> <td rowspan="3"> <b>FLITWAY TECHNOLOGIES</b>          6100 INDUSTRIAL COURT GREENDALE, WI 53129   <b>MONTGOMERY WATSON</b> </td> </tr> <tr> <td>DESIGNED BY</td> <td>4-26-04</td> </tr> <tr> <td>CHECKED BY</td> <td></td> </tr> </table>	INITIAL	DATE	<b>FLITWAY TECHNOLOGIES</b> 6100 INDUSTRIAL COURT GREENDALE, WI 53129  <b>MONTGOMERY WATSON</b>	DESIGNED BY	4-26-04	CHECKED BY								
INITIAL	DATE	<b>FLITWAY TECHNOLOGIES</b> 6100 INDUSTRIAL COURT GREENDALE, WI 53129  <b>MONTGOMERY WATSON</b>														
DESIGNED BY	4-26-04															
CHECKED BY																
<table border="1"> <tr> <td>DECIMALS</td> <td>FRACTIONS</td> <td>ANGLES</td> </tr> <tr> <td></td> <td>FRACTIONS 1/16</td> <td>FILLET RADIUS</td> </tr> <tr> <td></td> <td></td> <td>SURFACE FINISH</td> </tr> </table>	DECIMALS	FRACTIONS	ANGLES		FRACTIONS 1/16	FILLET RADIUS			SURFACE FINISH	<table border="1"> <tr> <td>SCALE</td> <td>NO. 12584 TOP VIEW</td> <td>REV 3</td> </tr> <tr> <td>DATE</td> <td></td> <td></td> </tr> </table>	SCALE	NO. 12584 TOP VIEW	REV 3	DATE		
DECIMALS	FRACTIONS	ANGLES														
	FRACTIONS 1/16	FILLET RADIUS														
		SURFACE FINISH														
SCALE	NO. 12584 TOP VIEW	REV 3														
DATE																
<small>REMOVE ALL DIMS &amp; BREAK EDGES</small>		<table border="1"> <tr> <td>SCALE</td> <td>NO. 12584 TOP VIEW</td> <td>REV 3</td> </tr> <tr> <td>DATE</td> <td></td> <td></td> </tr> </table>	SCALE	NO. 12584 TOP VIEW	REV 3	DATE										
SCALE	NO. 12584 TOP VIEW	REV 3														
DATE																



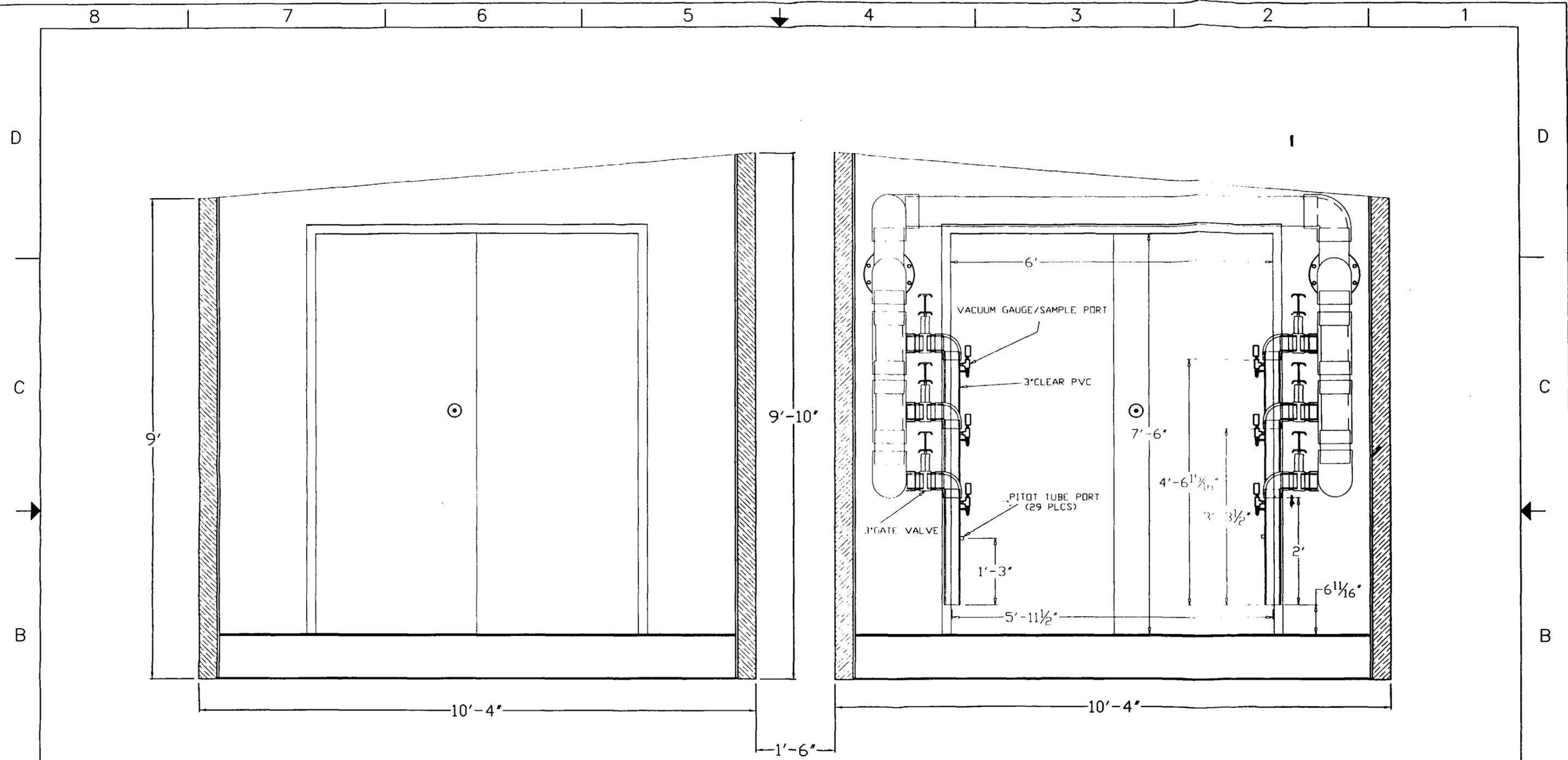
VIEW A A

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<b>DO NOT SCALE DRAWING</b>		INITIAL	DATE	<b>FLITWAY TECHNOLOGIES</b> 6100 INDUSTRIAL COURT GREENDALE, VT 53129	
<small>DECIMALS</small> <small>FRACTIONS</small> <small>ANGLES</small> 34/17 <small>FACINGS</small> 31/16 <small>FILED</small> PER TO JAW <small>REMOVE ALL DIMS &amp; BREAK EDGES</small>		<small>ISSUED</small> <small>REVISIONS</small> <small>DATE</small> <small>BY</small>	<small>DATE</small> <small>BY</small>	<b>MONTGOMERY WATSON</b> NONE D 12584 VIEW A-A 3	



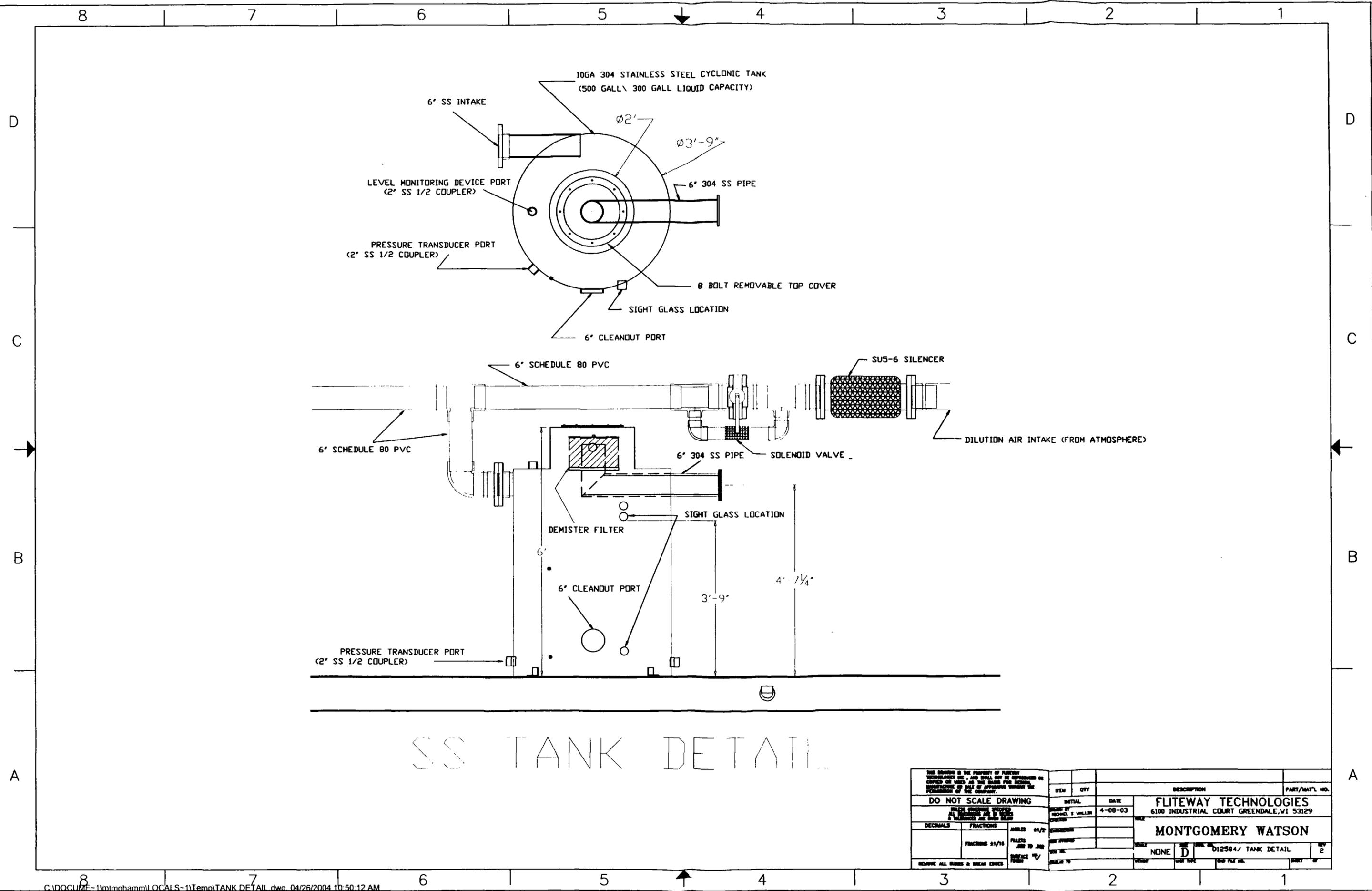
VIEW B-B

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<b>DO NOT SCALE DRAWING</b>		INITIAL	DATE	<b>FLITWAY TECHNOLOGIES</b> 6100 INDUSTRIAL COURT GREENDALE, VI 33129	
<small>DECIMALS</small>		<small>FLITWAY TECHNOLOGIES</small>	<small>4-26-04</small>	<b>MONTGOMERY WATSON</b>	
<small>FRACTIONS</small>	<small>ANGLES</small>	<small>AS PER</small>	<small>SCALE</small>	<small>SCALE</small>	<small>SCALE</small>
<small>FRACTIONS 21/16</small>	<small>AS PER</small>	<small>SCALE</small>	<small>SCALE</small>	<small>SCALE</small>	<small>SCALE</small>
<small>REMOVE ALL DIMS &amp; BREAK EDGES</small>	<small>SCALE</small>	<small>SCALE</small>	<small>SCALE</small>	<small>SCALE</small>	<small>SCALE</small>



VIEW C-C

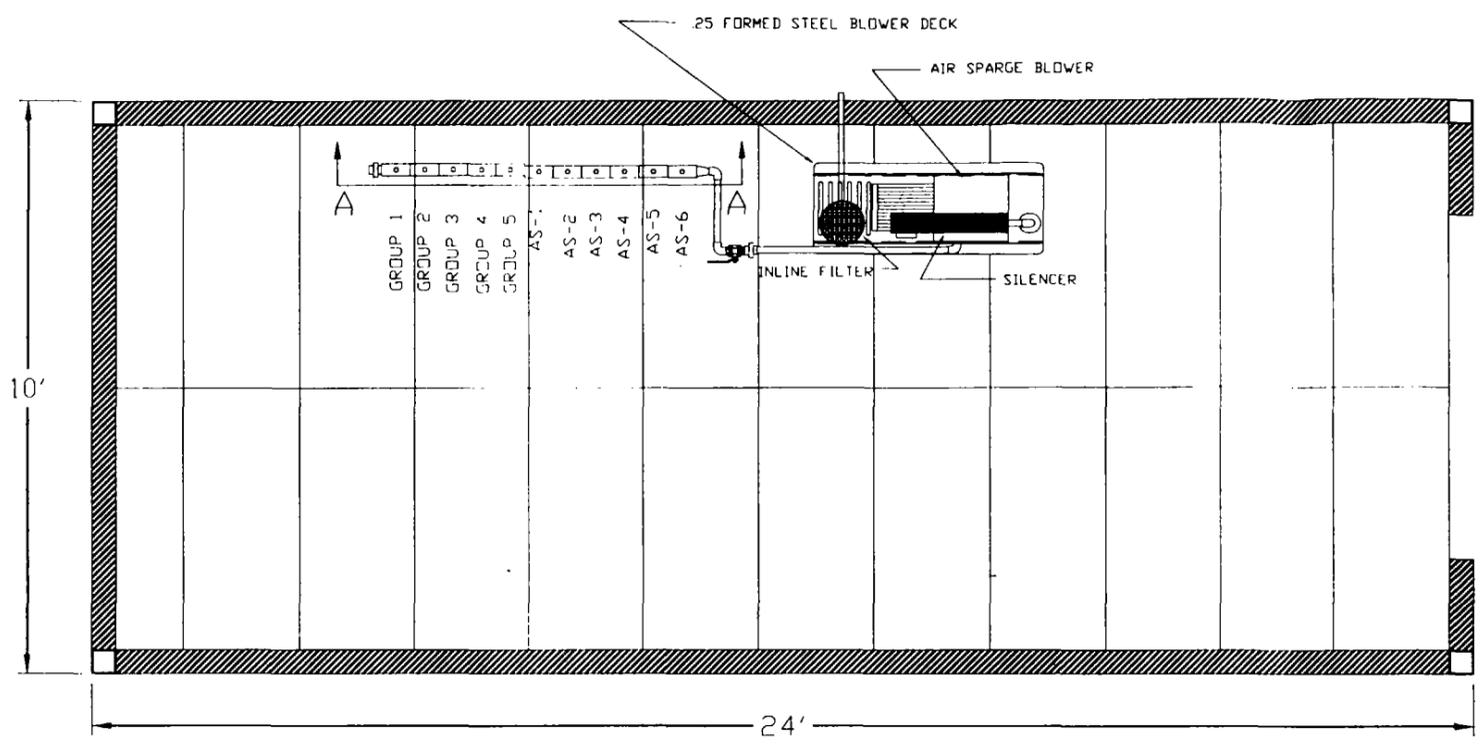
<small>THIS DRAWING IS THE PROPERTY OF FLITWAY TECHNOLOGIES INC., AND SHALL NOT BE REPRODUCED OR COPIED OR USED IN ANY MANNER FOR REPRODUCTION OR SALE OF APPLIANCES WITHOUT THE PERMISSION OF THE COMPANY.</small>		ITEM	QTY	DESCRIPTION	PART/MAT'L NO.
<b>DO NOT SCALE DRAWING</b> <small>UNLESS OTHERWISE SPECIFIED          ALL DIMENSIONS ARE TO FACE          &amp; UNLESS NOTED OTHERWISE</small>		INITIAL	DATE	<b>FLITWAY TECHNOLOGIES</b> 6100 INDUSTRIAL COURT GREENDALE, VI 53129	
DECIMALS <input type="checkbox"/>	FRACTIONS <input type="checkbox"/>	ANGLES <input type="checkbox"/>	SURFACES <input type="checkbox"/>	<b>MONTGOMERY WATSON</b>	
FRACTIONS 1/16 <input type="checkbox"/>	FILLETS <input type="checkbox"/>	SURFACE FINISH <input checked="" type="checkbox"/>	SCALE TO <input type="checkbox"/>	SCALE NONE <input checked="" type="checkbox"/>	DRAWING NO. 12584 VIEW C-C REV 3
<small>REMOVE ALL BURRS &amp; BREAK EDGES</small>		CHECKED BY MICHAEL S. WALKER	DATE 4-26-04	DRAWN BY MONTGOMERY WATSON	PART/MAT'L NO.



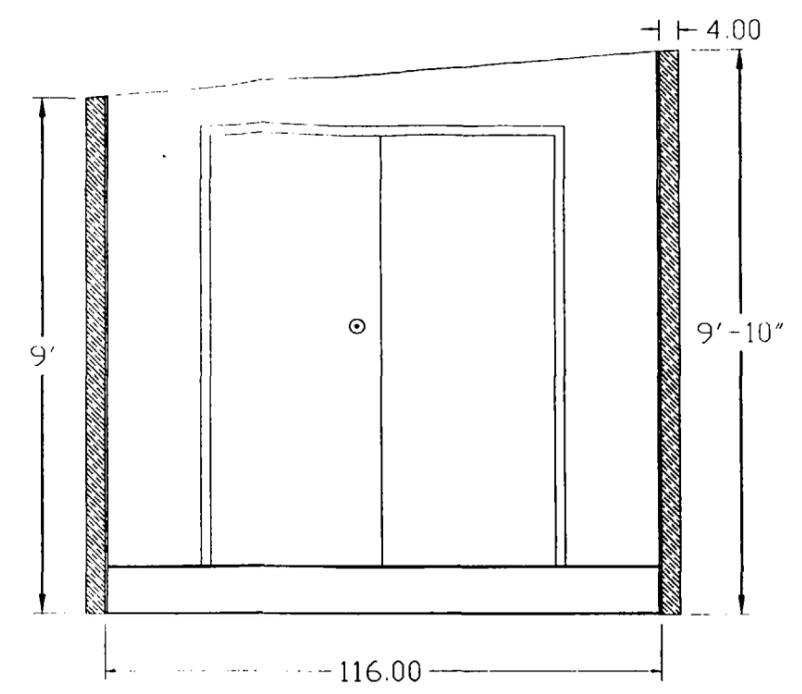
# SS TANK DETAIL

<small>THIS DRAWING IS THE PROPERTY OF FLITWAY TECHNOLOGIES INC. AND SHALL NOT BE REPRODUCED OR COPIED OR USED IN ANY MANNER FOR REPRODUCTION OR SALE OF APPROXIMATE WITHOUT THE PERMISSION OF THE COMPANY.</small>		ITEM QTY DESCRIPTION PART/MAT'L NO.
<b>DO NOT SCALE DRAWING</b> <small>UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES &amp; DECIMALS UNLESS OTHERWISE SPECIFIED</small>		INITIAL DATE 4-08-03
DECSIMALS FRACTIONS ANILES 01/2 FRACTIONS 01/16 SURFACE TV FINISH		<b>FLITWAY TECHNOLOGIES</b> 6100 INDUSTRIAL COURT GREENDALE, VI 53129 <b>MONTGOMERY WATSON</b> NONE D 012584/ TANK DETAIL 2
<small>REWORK ALL DIMS &amp; BREAK EDGES</small>		CHECKED BY DATE

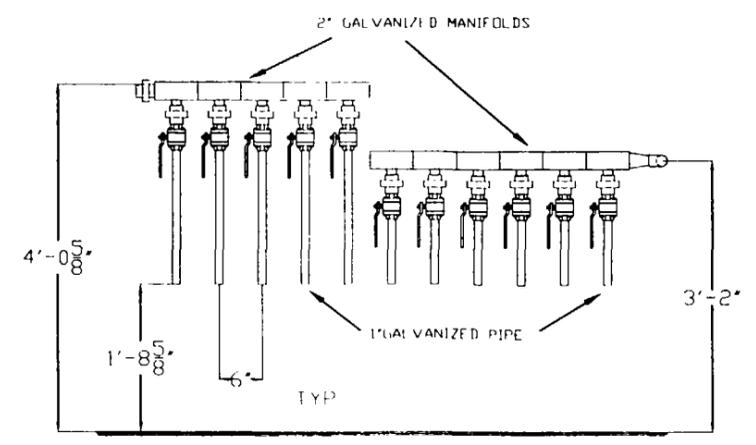
8 7 6 5 4 3 2 1



B  
B



VIEW B-B



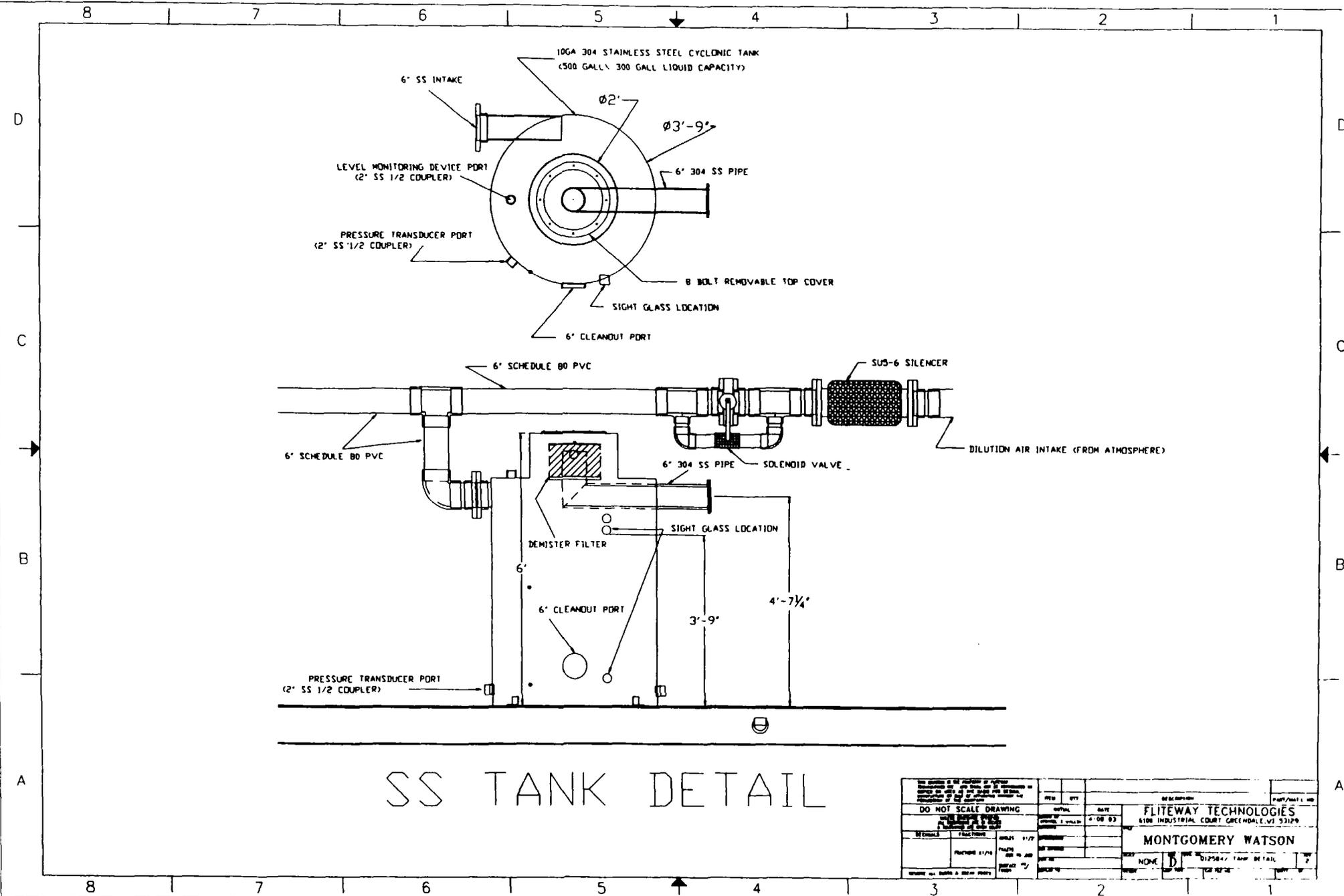
VIEW A-A

THIS DRAWING IS THE PROPERTY OF FLITWAY TECHNOLOGIES INC. AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR DESIGN, MANUFACTURE OR SALE OF APPARATUS WITHOUT THE PERMISSION OF THE COMPANY.				ITEM	QTY	DESCRIPTION	PART/MAT'L NO.
<b>DO NOT SCALE DRAWING</b>				INITIAL	DATE	FLITWAY TECHNOLOGIES 6100 INDUSTRIAL COURT GREENDALE, WI 53119	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES & TOLERANCES ARE GIVEN BELOW				DRAWN BY MICHAEL S. WALLIN	3-12-03	TITLE MWH AIR SPARGE LAYOUT	
DECIMALS	FRACTIONS	ANGLES	1/2"	CHECKED		SCALE NONE	
	FRACTIONS 31/16	FILLETS	OSR TO OSR	TECH APPROVED		SIZE D	DWG NO. 0120014
REMOVE ALL BURRS & BREAK EDGES				SURFACE FINISH		WEIGHT	UNIT LBS

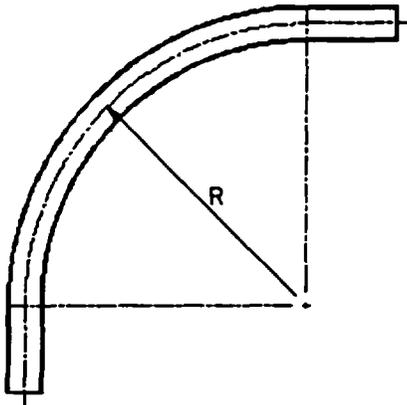
3 2 1

**APPENDIX G-**

**SYSTEM BUILDING EQUIPMENT AND MATERIAL SPECIFICATIONS**



DO NOT SCALE DRAWING		REV	QTY	DATE	DESCRIPTION	PART/ASST. C. NO.
REV	DESCRIPTION	DATE	BY	CHECKED	APPROVED	
1	ISSUED FOR FABRICATION	4-08-93				
2	REVISED					
3	REVISED					
4	REVISED					
5	REVISED					
6	REVISED					
7	REVISED					
8	REVISED					
MONTGOMERY WATSON				FLITEWAY TECHNOLOGIES		
5108 INDUSTRIAL COURT GREENDALE, VT 05129						
NONE				DISPENS. TANK DETAIL		7



**90° Sweep Ells**  
AWWA C906-99 Available -  
Call for Quote\*

90° Sweep Ells Size (IPS)	Pressure Class (psi)	Feed Stock	Weight (lbs.)	Plant	Radius*				Reference Code
					24"	36"	40"	60"	
2"	128	DR 11	4.0	AB	C.F.Q.	C.F.Q.	-	-	*F*S90D*
3"	128	DR 11	10.0	AB	-	C.F.Q.	-	-	*F*S90D*
4"	128	DR 11	26.0	AB	-	-	-	C.F.Q.	*F*S90D*
6"	128	DR 11	55.0	AB	-	-	-	C.F.Q.	*F*S90D*
8"	128	DR 11	71.0	AB	-	-	C.F.Q.	-	*F*S90D*

- ^ - Minimum order quantity is (5).  
 - Dimensions and weights are approximate and subject to change.  
 - Drawing No. - CU70B650

**PERFORMANCE PIPE**, a division of  
Chevron Phillips Chemical Company LP  
PO Box 269006  
Plano, TX 75026-9006  
Phone: 1-800-527-0662  
Fax: 972-599-7348

Web:  
[www.performancepipe.com](http://www.performancepipe.com)



## High Solids, Water-Based Epoxy Primer & Coating

### DESCRIPTION:

AGUA-ROCK is a proprietary "water-based", 2-component, penetrating epoxy coating that offers excellent adhesion and abrasion resistance. It outperforms and outlasts most solvent-based sealer systems without the associated odors, flammability, or VOC's. AGUA-ROCK meets all of the USDA guidelines for use in federally inspected facilities. AGUA-ROCK is available in clear, gray and a variety of other colors using ROCK-TRED's Colorants.

### RECOMMENDED USES:

AGUA-ROCK is the recommended primer for most ROCK-TRED Flooring Systems. It is also recommended as a stand alone coating in areas that are subjected to medium to heavy traffic and moderate chemical spillage. AGUA-ROCK is also the ideal product over substrates that face moisture vapor issues, and oil saturation.

### FEATURES:

- Waterborne
- Solvent-Free ... Odorless
- Fast Drying Time
- Easy Mixing Ratio
- Applies to Damp Concrete
- Zero VOC's
- Good Abrasion Resistance
- Eliminates Concrete Dust
- Moderate Chemical Resistance
- Can be applied to "Green" concrete
- Seals in Minor Oil and Grease contamination
- Excellent Adhesion
- No Induction Time
- Good Mar Resistance
- Cleans Easily
- Gloss or Satin Finish
- Hides in One Coat
- 21 Standard Colors
- "Breathable"

### PACKAGING:

- ¾ Gallon Unit (2.84 Liters) packaged in a single carton
- ROK-PAK™ 3 Gallon Unit (11.4 Liters)
- 6 Gallon Unit (23 Liters) packaged in pre-proportioned 3 gallon (11.4 Liters) mixes
- 15 Gallon Unit (57 Liters) filled in 5 gallon (19 Liter) pails
- 165 Gallon Unit (625 Liters) in Drums (Clear gloss only)



### PHYSICAL/CHEMICAL CHARACTERISTICS:

Shelf Life	2 years (between 50°F and 85°F) (10°C and 29°C)
Application Temp & Humidity	55°F to 85°F (13°C to 29°C) @ less than 70% R.H.
Mixing Ratio: Hardener to Resin	Clear: 2 to 1 by volume, 1.8 to 1 by weight Gray: 2 to 1 by volume, 2 to 1 by weight
Color of: Resin: Clear Hardener: Amber Mixed: White Dry: Clear	
Coverage	250 - 300 sq. ft. per gallon (6.14 - 7.36 m <sup>2</sup> /L)
Working Time	35 minutes @ 75°F (24°C)
Application Method	Straight Squeegee & 3/8" (.95 cm) Lint Free Nap Roller
Ready for Recoat	2 - 5 hours
Ready for Foot Traffic	7 - 12 hours
Ready for Heavy Traffic	24+ hours
Bond Strength	400+ psi (2758 kPa) w/ concrete failure (ASTM D-4541)
% Solids by Volume	52% Clear, 60% Pigmented (ASTM D-1464)
Flash Point	>200°F (93°C) (PMCC)
UV Light Resistance	Good (QUV)
Hardness (Shore D)	80+ (ASTM D-2240)
VOC	0 lbs/gal (0 g/l) (EPA Method 24)
Gloss (60°)	75 (50 for satin)
Impact Resistance	>160 in-lbs (18.08 N·m) (ASTM D-4226)
Indentation	None (MIL-D-3134F)
Abrasion Resistance	0.06 g (ASTM D-4060, CS-17 wheel)
Flammability	Self-Extinguishing (ASTM D-635)
Heat Resistance Limitation	140°F (60°C) Constant 200°F (93°C) Intermittent
Water Absorption	0.2% (ASTM C-413)
Coefficient of Friction	0.77 (ASTM F-609) with texture
Viscosity (Mixed)	1500+/- cps.

Based upon a seven day cure at 75°F (24°C)

## COVERAGE:

This product should be applied at the rate of approximately 300 sq. ft. per gallon (7.36 m<sup>2</sup>/L), which is approximately 5.35 wet mils (0.135 mm). With Gray and other colors, as well as over porous surfaces, the coverage rate should be 250 sq. ft. per gallon (6.14 m<sup>2</sup>/L). As with all coatings, coverage is dependent on the smoothness and porosity of the surface.

## SURFACE PREPARATION:

The substrate must be clean, dry and sound with new concrete cured for at least 30 days at 70°F (21°C). However, AGUA-ROCK can be applied to "Green" concrete after 48 hours, and the laitance must be removed. Remove dust, laitance, grease, curing compounds, waxes, foreign particles, disintegrated or soft base materials, and any previously applied potentially incompatible coatings. Create a surface profile on the substrate by either steel shot blasting or acid etching. Level floor and repair joints in accordance with ROCK-TRED's Floor Patching & Joint Repair Guide. For additional floor preparation information and methods, refer to ROCK-TRED's Surface Preparation Guide. If the substrate is not prepared properly, product adhesion will fail and warranties will be voided.

## FOR BEST RESULTS:

- Recommended for Interior Use Only. In Outdoor applications, heavy exposure to UV rays will cause color change over time.
- New Concrete Must Cure For at Least 30 Days @ 70°F. (21°C)
- If applying over "Green" concrete, remove all laitance by shot blasting and apply up to two coats maximum.
- DO NOT thin the AGUA-ROCK.
- DO NOT Use when Humidity Exceeds 70% Indoors. If this occurs, use powerful industrial fans to create air flow away from the coating.
- Not recommended for areas of constant immersion or constant direct exposure to water.
- DO NOT Allow Material to Puddle During Application.
- Allow Each Coat to Dry Tack-Free before Recoating.
- Apply Each Coat Within 72 Hours of Previous Coat.
- Discard any Material Subjected to Freezing.
- DO NOT Use any material beyond its shelf life.
- DO NOT Apply to Structurally Unsound Surfaces.
- DO NOT apply heavier than recommended wet film thickness.
- Apply a Test Patch to Ensure Adhesion To Old Paint.
- Use Large Fans to Help Curing Process, if necessary.

Review ROCK-TRED'S Material Safety Data Sheets (MSDS) for this product prior to mixing and applying. In addition, thoroughly review the Data Sheet and product labels. Por favor, póngase en contacto con ROCK-TRED Corporation al núm. telefónico 1800-762-8733 para la Hoja de Datos del Material y la Hoja de Datos de Seguridad (MSDS) en español. (Deje su núm. de teléfono).

## MIXING:

Avoid mixing and application of this product if the floor temperature is below 55°F (13°C) or above 85°F (29°C). Also avoid application if the humidity is higher than 70% R.H. or lower than 25%. The temperature of the floor, materials and air in the area of the installation all play a role in how the product will apply and cure. Do NOT turn the buckets upside down, as unmixed material may wind up on the floor and never cure. For ½ gallon (2.84 L) and 6 gallon (23 L) units: Carefully pour the Resin container into the Hardener Container. DO NOT change the ratio of Resin to Hardener. Blend thoroughly

## WARRANTY STATEMENT:

Information about ROCK-TRED products is given to the best of our knowledge, based on tests and experience. Such information supplied about our products is not a representation or a warranty. It is supplied on the condition that you will make your own tests to determine the suitability of the product for your particular purpose. As products are often applied or used under conditions beyond our control, ROCK-TRED cannot guarantee anything but the quality of its products. ROCK-TRED warrants that its products meet the specifications set forth by ROCK-TRED, but we reserve the right to change any given specification without prior notice. ROCK-TRED DISCLAIMS ALL WARRANTIES RELATING TO THE PRODUCTS AND THEIR APPLICATION, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Receipt of ROCK-TRED products constitutes acceptance of the terms of this limited warranty and the terms and the conditions set out in our invoice, contrary provisions of buyer's purchase documents notwithstanding. Upon receipt of merchandise, purchaser has 30 days to notify ROCK-TRED in writing that materials are defective. In the event ROCK-TRED finds that the product delivered is off specification, ROCK-TRED will, at its sole discretion, either replace the product or refund the purchase price thereof, and ROCK-TRED's choice of one of these remedies is the buyer's sole remedy. In no event shall the liability of ROCK-TRED exceed the purchase price of shipped merchandise. Claims must be in writing. Claims after 30 days are void. ROCK-TRED will under no circumstances be liable for special, incidental or consequential damages. This warranty supercedes all other guarantees, whether oral or written, and whether expressed, implied or statutory. No representative is authorized to make any representation or warranty or assume any other liability on our behalf with any sale of our products. Certain products may contain chemicals which may cause serious physical injury. Before using, please read the Material Safety Data Sheet and follow all precautions to prevent bodily harm.

for 2 minutes with a spiral mixing blade (available from ROCK-TRED) attached to a low-speed (400-600 RPM) electric drill.

Take care not to induce air into the material when mixing. This will cause "bubbles" in the coating when applied. For Rok-Pak Units: Remove bags from container. Grab the Hardener Bag by the Yellow handle, and cut open where indicated, and pour into pail provided. Follow the same procedure with the Resin Bag, then mix as stated above. For bulk units: Portion out 2 gallons (7.6 L) of Hardener and 1 gallon (3.8 L) of Resin into a clean 5 gallon pail (19 L). Blend in accordance with directions stated above. Colorants: For most colors, add 1 quart per three gallon mix (.95 L per 11.4 L) before blending. See the ROCK-TRED Colorant data sheet for specific instructions.

## POT LIFE:

At 75°F (24°C) and 50% R.H., the AGUA-ROCK has a useful working time or pot life of 30-40 minutes. Using any product beyond this time will result in variable results and therefore any mixed product beyond the pot life should be discarded. Apply all material to the floor as quickly as possible to increase working time.

## APPLICATION:

The individual(s) applying the AGUA-ROCK should be wearing "spiked sandals" available from ROCK-TRED. The recommended application of this product involves pouring it in a narrow line directly onto the concrete surface and then spreading it with a flat squeegee. Spread the coating in a continuous manner from one side of the area being coated to the other. Immediately follow with a 3/8" (.95cm) nap shed resistant roller. The AGUA-ROCK must be rolled as evenly as possible. To do this, roll forward in a straight line and then roll the same column backwards to eliminate spike shoe marks. Overlap the next column to be rolled by ½" (1.3cm) with the previously rolled column. Avoid excess agitation of the liquids with the roller. This will lessen chances of bubbling of the final film. If bubbles or "fisheyes" occur, it is recommended to re-roll the coating, either with a spiked or fresh shed resistant roller. The AGUA-ROCK should be applied at the rate of 300 sq. ft. per gallon (7.36m<sup>2</sup>/L). On rougher areas and shot-blasted floors, the coverage rates will be reduced to about 250 sq. ft. per gallon (6.14m<sup>2</sup>/L). Allow the AGUA-ROCK to dry thoroughly before mixing and applying the next coat. It should be tack free in appearance before recoating (this takes between 4-5 hours @ 75 °F (24°C) and 50% R.H).

## CLEAN UP:

Application equipment should be cleaned using soap and water immediately after use, or solvent if necessary.

## DISPOSAL:

Empty containers may contain product residue, including flammable or combustible vapors. Do not cut, puncture or weld near these containers. Label warnings must be observed until containers have been commercially cleaned or reconditioned. Containers to be thrown out must be disposed in accordance with federal, state and local regulations. Use only licensed hazardous waste disposal companies.

## MAINTENANCE:

For optimal floor appearance and performance following installation, refer to ROCK-TRED's Floor Maintenance Instructions.

## CUSTOMER NOTE:

For information on application situations not covered above, contact your local ROCK-TRED representative or the corporate office at 847-673-8200.

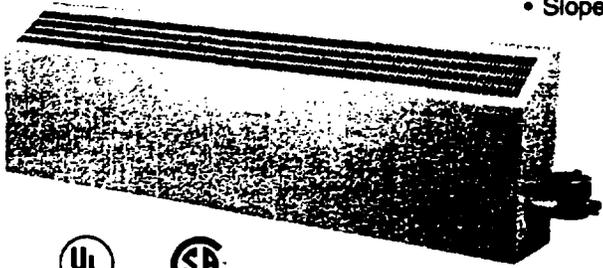


AGUA-ROCK DATA SHEET REV: 05/03  
Manufacturing and Headquarters: 3415 Howard St., Skokie, IL 60076-4032 U.S.A.  
(800) ROC-TRED • (800) 762-8733 • (847) 673-8200 • FAX (847) 679-6665  
www.rocktred.com

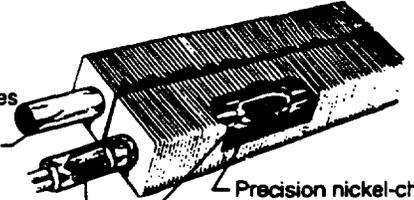
# HAZARDOUS LOCATION CONVECTION HEATER

- Cabinet size 18" high, 9" wide
- Color beige powder coat textured finish
- Heavy duty 16 Ga. Steel
- Fully assembled unit
- Slope Top Design

Element assembly pressure tested to 100 pounds per square inch to protect against air leakage into element.



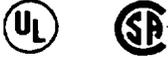
Corrosion-Resistant Sheath provides resistance to oxidation, corrosion, plus a broad range of chemicals and atmospheres.



Lead Arrangement. Solid nickel pins overlap the resistance windings inside the core. Pins are permanently connected during the swaging operation for trouble-free electrical continuity.

Precision nickel-chromium windings centered in the unit for even, efficient heat.

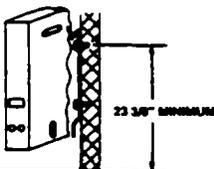
Efficient dielectric compacted to a predetermined density results in good heat transfer, and strength to withstand normal shock and vibration.



NEMA 4  
Hose Down  
Rated

ALL T-2A Models  
normal stock  
items, contact  
Factory for lead-  
time on all T-3A  
Models

Wall Mounting  
Brackets  
(standard with Heater)



Hazardous Location Heater is easily installed by one person.

Junction box extends 5-1/2" from the right end of the housing

A 9 inch minimum space from bottom of heater to the floor is required for ample air flow.

LISTINGS	UPC 686334	MODEL	WATTS	BTU	VOLTS	AMPS	CABINET LENGTH	NO. OF ELEMENTS	MAX FUSE SIZE	WT.
CLASS 1, GROUP B, C & D DIVISION 1 & 2 (T-2A) 280° C / 536° F UL LISTED & CSA NRTL/C CERTIFIED	655002	FEP-1812-1RA			120	15.0			20	
	655019	FEP-1820-1RA			208	8.7			10	
	655026	FEP-1824-1RA	1800	6143	240	7.5	34"	1	10	50 lbs.
	655033	FEP-1827-1RA			277	6.5			10	
	655040	FEP-1848-1RA			480	3.8			5	
	655057	FEP-3620-1RA			208	17.3			20	
	655064	FEP-3624-1RA			240	15.0			20	
	655071	FEP-3627-1RA	3600	12286	277	13.0	34"	2	15	54 lbs.
	655068	FEP-3648-1RA			480	7.5			10	
	655170	FEP-3857-1RA			600	6.0			10	
	655095	FEP-3820-1RA			208	18.3			20	
	655101	FEP-3824-1RA	3800	12969	240	15.8	58"	1	20	80 lbs.
	655118	FEP-3827-1RA			277	13.7			15	
	655125	FEP-3848-1RA			480	7.9			10	
CLASS 1, GROUP B, C & D DIVISION 1 & 2 (T-3A) 180° C / 356° F CSA NRTL/C CERTIFIED	655132	FEP-7620-1RA			208	36.5			40	
	655149	FEP-7624-1RA			240	31.7			35	
	655156	FEP-7627-1RA	7600	25938	277	27.4	58"	2	30	85 lbs.
	655163	FEP-7648-1RA			480	15.8			20	
	655187	FEP-7857-1RA			600	12.7			15	
	655194	FEP-0812-1RA			120	6.7			10	
	655200	FEP-0820-1RA			208	3.8			5	
	655217	FEP-0824-1RA	800	2730	240	3.3	34"	1	5	50 lbs.
	655224	FEP-0827-1RA			277	2.9			5	
	655231	FEP-0848-1RA			480	1.7			5	
	655248	FEP-1612-1RA			120	13.3			15	
	655255	FEP-1620-1RA			208	7.7			10	
	655262	FEP-1624-1RA	1600	5460	240	6.7	34"	2	10	54 lbs.
	655279	FEP-1627-1RA			277	5.8			10	
	655286	FEP-1648-1RA			480	3.3			5	
	655385	FEP-1657-1RA			600	2.7			5	
	655293	FEP-1712-1RA			120	14.2			20	
	655309	FEP-1720-1RA			208	8.2			10	
655316	FEP-1724-1RA	1700	5802	240	7.1	58"	1	10	80 lbs.	
655323	FEP-1727-1RA			277	6.1			10		
655330	FEP-1748-1RA			480	3.5			5		
655347	FEP-3420-1RA			208	16.3			20		
655354	FEP-3424-1RA			240	14.2			20		
655361	FEP-3427-1RA	3400	11604	277	12.3	58"	2	15	85 lbs.	
655378	FEP-3448-1RA			480	7.1			10		
655392	FEP-3457-1RA			600	5.7			10		

WARNING: Do not operate heaters in ambient temperatures exceeding 40°C (104°F).

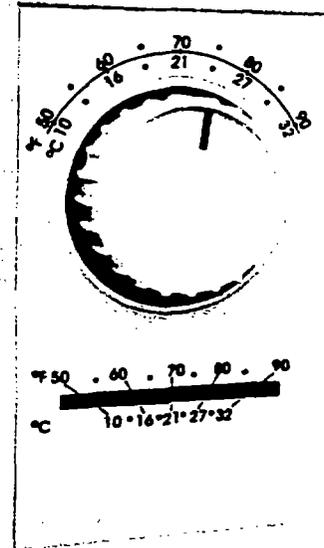
## HAZARDOUS LOCATION THERMOSTAT - REMOTE MOUNTED

UPC 686334	MODEL	DESCRIPTION	WT.
538107	EPETD8S	50 - 90 °F 24-277 VOLT SPST	5 lbs.
835077	EPETD8D	50 - 90 °F 24-277 VOLT DPST	5 lbs.



**ET Thermostats Feature:**

- Single & Double Pole designs
- Fahrenheit & Celsius Temperature Scale
- Anticipated Models
- Shadow White Color
- Optional Wire leads
- With or Without Thermometer
- DP models incorporate Positive Off
- UL Listed / CSA Certified



ET5STS Pictured

CATALOG #	PCN #	DESCRIPTION	STD. LT	VOLTAGE	MAX-AMP
AET5DWS	05387202	DP Line Voltage Stat W/Anticipator with Leads	Stock-3W	120-277V	22AMPS
AET5SWS	05387302	SP Line Voltage Stat W/Anticipator with Leads	Stock-3W	120-277V	22AMPS
EPETD8D	05380702	DPDT Hazardous Location Thermostat	Stock-3W	120-277V	22AMPS
EPETD8S	05381002	SPDT Hazardous Location Thermostat	Stock-3W	120-277V	22AMPS
ET5DS	05388802	Double Pole Heat Only	Stock-3W	120-277V	22AMPS
ET5D4S	05387402	Double Pole with 35-75°F Temp Range	Stock-3W	120-277V	22AMPS
ET5DTS	05387502	DP Heat Only with Thermometer	Stock-3W	120-277V	22AMPS
ET5DWS	05387602	DP Heat Only with Leads	Stock-3W	120-277V	22AMPS
ET5MS	05387702	Two Stage Heat Only Thermostat	Stock-3W	120-277V	22AMPS
ET5SS	05387802	SP Heat Only	Stock-3W	120-277V	22AMPS
ET5S4S	05387902	SP Heat Only W/35-75°F Temperature Range	Stock-3W	120-277V	22AMPS
ET5SRS	05388002	SP Cool Only	Stock-3W	120-277V	22AMPS
ET5SRTS	05388902	SP Cool Only with Thermometer	Stock-3W	120-277V	22AMPS
ET5STS	05388102	SP Heat Only with Thermometer	Stock-3W	120-277V	22AMPS
ET5SWS	05388202	SP Heat Only with Leads	Stock-3W	120-277V	22AMPS
ETD5MS	05388302	Double Throw 2 Stage Heat 1 Stage Cool	Stock-3W	120-277V	22AMPS
ETD5MTS	05388402	Two Stage Heat / 1 Stage Cool with Thermometer	Stock-3W	120-277V	22AMPS
ETD5SS	05388502	SPDT Heat or Cool	Stock-3W	120-277V	22AMPS
ETD5STS	05388602	SPDT Heat or Cool W/Thermometer	Stock-3W	120-277V	22AMPS

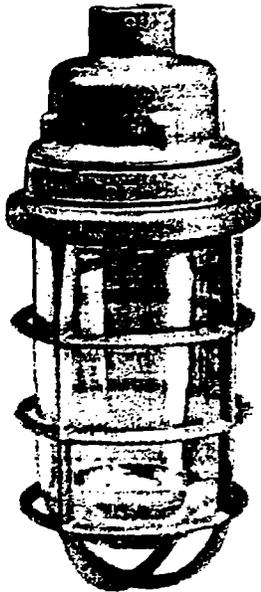
**ET Thermostat Information**

Product Size			Individual Box Size			Master Box Size			Mstr Box	Ind. Box	Mstr Box
H	W	D	L	W	H	L	W	H	Qty	Weight	Weight
4.75"	2.8"	1.5**	4.75"	3"	2.75	16"	14.5"	6"	25	<1 LB	19 lbs.

\*Depth measurement is from wall to top of knob. It does not include section that is inside junction box.

**EPET Thermostat Information**

Product Size			Individual Box Size			Master Box Size			Mstr Box	Ind. Box	Mstr Box
H	W	D	L	W	H	L	W	H	Qty	Weight	Weight
5.5"	6.375	5.625	6.5"	7"	5.75"				4	6 lbs.	24 lbs.



Enclosed & Gasketed\*

 Listed - File E10514

 Certified - File LR11713

**V SERIES  
ENCLOSED & GASKETED  
Applications**

Locations requiring durable, protected lighting fixtures  
Wet and dirt laden locations, such as industrial environments requiring enclosed and gasketed (vaportight) fixtures

Lighting walkways, tunnels, loading docks, exits, stairwells, etc  
Fixtures intended for base-up mounting

Heat resistant glass globes recommended for wet locations

**Features**

- ✓ Electrostatically applied epoxy/polyester finish
- ✓ Enclosed and gasketed fixture (vaportight). Joint gaskets provided to seal out moisture and dirt
- ✓ Splice box selections include pendant, ceiling, bracket and stanchion mounting types
- ✓ Modular design permits selection of splice box, fixture body, globe, guard and reflector for specific or custom applications
- ✓ Hubs are threaded for attachment to conduit and set screws are provided in pendant fixtures
- ✓ Copper-free aluminum (less than 4/10 of 1%) construction with electrostatically applied epoxy/polyester finish resists corrosion



Class I, Div. 2, Groups A,B,C,D  
Class I, Zone 2, Groups IIC,IIB,IIA  
NEMA 3, 4 - When used with tempered glass

 Listed - File E10514

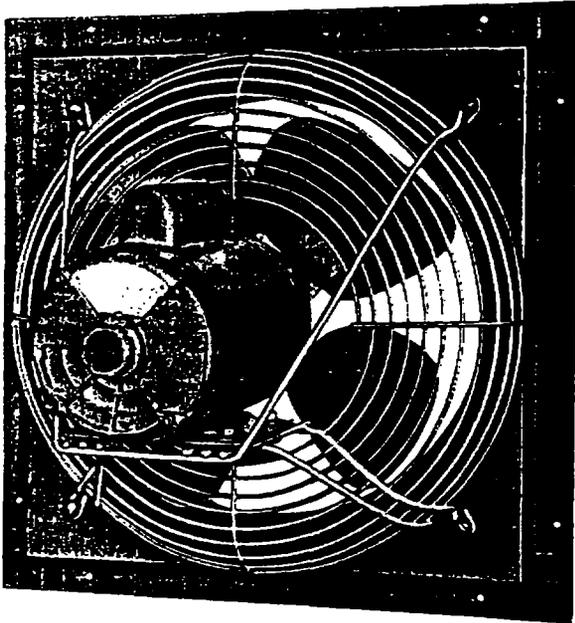
UL-1571 Standard for incandescent fixtures

UL-844 Standard for hazardous location fixtures

 Certified - File LR11713

CEILING FIXTURE WITH VGX SPLICE BOX							
FITTURE TYPE	LAMP WATT	HUB SIZE	CATALOG NUMBER	CONSISTS OF			
			FITTURE W/ GLOBE & GUARD	MOUNTING BOX	FITTURE BODY	CLEAR GLOBE*	GUARD
100	150	1/2"	VUXGG-1-100PX ①	VGX-1	VXFC-100 N34	VCGP-100	VAG-100
		3/4"	VUXGG-2-100PX ①	VGX-2	VXFC-100 N34	VCGP-100	VAG-100
200	300	1/2"	VUXGG-1-200PX ①	VGX-1	VXFC-200 N34	VCGP-200	VAG-200
		3/4"	VUXGG-2-200PX ①	VGX-2	VXFC-200 N34	VCGP-200	VAG-200

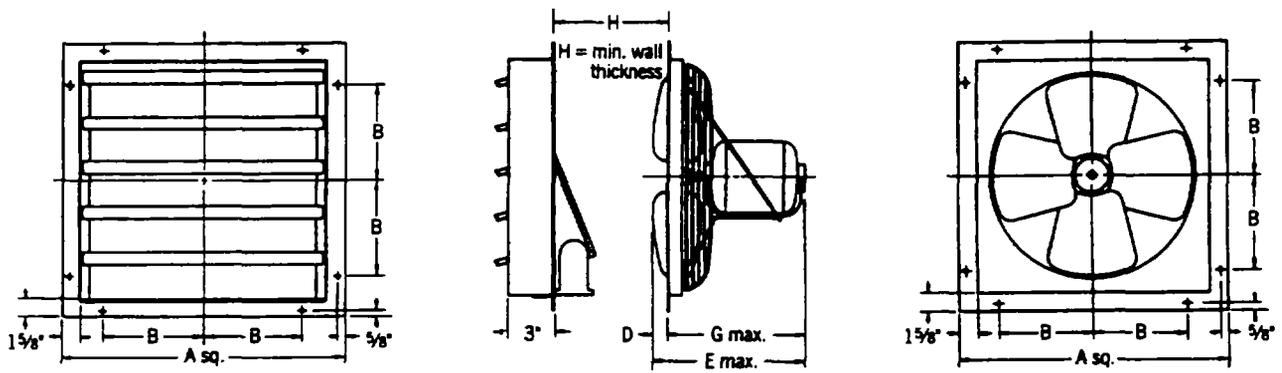
# DIRECT-DRIVE PROPELLER FANS



## MODEL N

### EXHAUST or SUPPLY

- **Eight wheel diameters**—8" through 24".
- **250 to 6400 CFM**—up to 1/2" static pressure.
- **Panels**—square steel construction with streamlined venturi inlet...venturi is reversed in supply-fan panels...baked-green enamel finish.
- **Wheels**—aluminum blades with steel hubs.
- **Motor mounts**—wire-guard-type motor mount [see photo at left] is standard on all Model N units...guard is zinc-plated steel.
- **Motors**—standard motors are totally enclosed air over with pre-lubricated ball bearings except 1/12 and 1/20 HP motors, which are shaded-pole totally enclosed permanently lubricated sleeve-bearing type. Motors 1/4 HP and larger are suitable for either horizontal or vertical service...specify "for vertical mounting" to have wheel locked to motor shaft...1/20 and 1/12 HP motors are not suitable for vertical service.

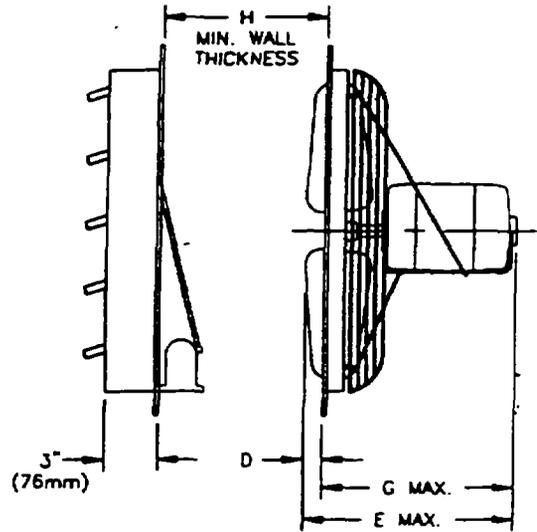
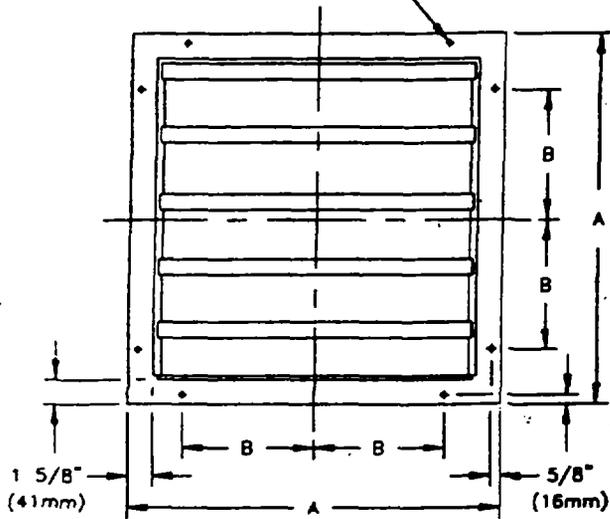


### SPECIFICATIONS DIMENSIONS IN INCHES.

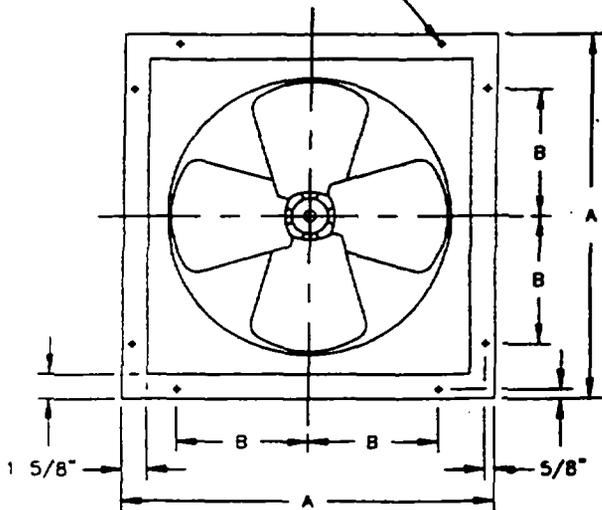
Application	Model	Wheel diameter	A	B	D	E†	G†	H minimum		Mounting hole no. and diameter		Weight* (lbs.)
								Auto-matic	Motor-operated	Fan	Shutter	
EXHAUST	EN82-	8	13 1/4	3		10 1/4	10 1/4	1 5/8	4 1/2	8 - 5/16	8 - 9/32	25
	EN102-	10	15 1/4	4	1/4	10 3/8	10 1/8	1 5/8	4 3/4	8 - 5/16	8 - 9/32	29
	EN122-	12	17 1/4	5	7/8	11 1/2	10 3/4	2	5 3/8	8 - 5/16	8 - 9/32	35
	EN142-	14	20 1/4	6 1/2	5/8	11 1/4	10 5/8	2	5 1/8	8 - 5/16	8 - 9/32	40
	EN162-	16	23 1/4	8	1	12	11	2	5 1/2	8 - 5/16	8 - 9/32	50
	EN182-	18	24 1/4	8 1/2	5/8	11 1/2	10 7/8	2	5 1/8	8 - 5/16	8 - 9/32	65
	EN202-	20	27 1/4	10	7/8	12 7/8	12	2	5 3/8	8 - 5/16	8 - 9/32	80
EN242-	24	30 1/4	11 1/2	1	13 3/8	12 3/8	2	5 1/2	8 - 5/16	8 - 9/32	95	
SUPPLY	SN82-	8	13 1/4	3		10 1/4	10 1/4	Auto-matic shutter not available	9 1/2	8 - 5/16	8 - 9/32	25
	SN102-	10	15 1/4	4		10 1/4	10 1/4		9 1/2	8 - 5/16	8 - 9/32	29
	SN122-	12	17 1/4	5		11	11		9 1/2	8 - 5/16	8 - 9/32	35
	SN142-	14	20 1/4	6 1/2		11 5/8	11 5/8		9 1/2	8 - 5/16	8 - 9/32	40
	SN162-	16	23 1/4	8	1/8	11 1/4	11 1/8		9 1/2	8 - 5/16	8 - 9/32	50
	SN182-	18	24 1/4	8 1/2		12	12		9 1/2	8 - 5/16	8 - 9/32	65
	SN202-	20	27 1/4	10		12 1/2	12 1/2		9 1/2	8 - 5/16	8 - 9/32	80
SN242-	24	30 1/4	11 1/2	1/4	12 1/2	12 1/4	9 1/2	8 - 5/16	8 - 9/32	95		

† E and G based on longest motor used for each size fan. \* Shipping weights shown are maximum and include totally enclosed motors and weight of packaging.  
 NOTE: Exhaust units are available with either automatic or motorized shutters. Supply units require motorized supply shutter.  
 When ordering, specify complete model number as shown on page 3. Dimensions not to be used for construction unless certified. Tolerance: ± 1/8"

(B)-9/32"(7mm) DIA. MTG. HOLES



(B)-5/16"(8mm) DIA. MTG. HOLES



EXHAUST UNITS ARE AVAILABLE WITH EITHER AUTOMATIC OR MOTORIZED SHUTTERS: SUPPLY UNITS REQUIRE MOTORIZED SUPPLY SHUTTER.

2-SPEED AND 3-SPEED INCLUDE SWITCH FOR CHANGING SPEED.

MOTORIZED SHUTTERS AVAILABLE FOR 115v. OR 230v. OPERATION. FOR 460v. OPERATION, A TRANSFORMER IS REQUIRED.

TOLERANCE:  $\pm 1/8"$  ( $\pm 3\text{mm}$ )

ITEM	DIMENSIONS	
	in	mm
A	17 1/4	438
B	5	127
D	7/8	22
E	11 1/2	292
G	10 3/4	-
H (automatic)	2	-
H (motorized)	5 3/8	-

**nyb** The  
New York Blower  
Company

7680 Quincy Street, Willowbrook, IL 60521

Propeller Fan Model N Supply

SIZE: 12

Date 12-05-02 Certified SAE

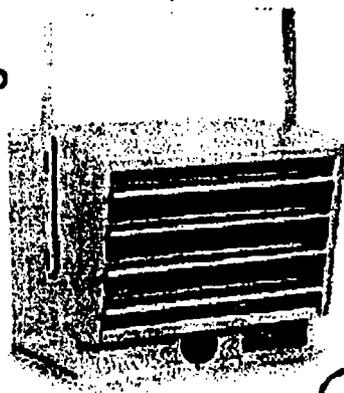
Drawing No. X02886-105-2 Rev.

# Dayton



Repair Parts Available  
1-800-323-0620

EXTENDED WARRANTY AVAILABLE



No. 3UG73

## Electric Utility Heaters

For primary or supplemental heating in factories, stores, garages, warehouses, public buildings, service stations, stockrooms, basements, toll booths, workshops, and any large exposed areas or additions. High limit thermal cutout automatically shuts off heater in the event of overheating. Choice of wattage and Bluh settings. Heater element features rugged plate fin.

Neutral gray baked enamel finish with contrasting bronze brown adjustable louvers. Ceiling-mount bracket included.

- Horizontal and downflow in one unit
- Built-in thermostat
- Automatic fan delay control
- 12½ H x 14W x 11¼ \*D not including bracket

KW	Bluh	Volts 60Hz.	Line Amps	Fan CFM	Temp. Rise (°F)	Stock No.	Shpg. Wt.
5/4.1/3.3/2.5	17.1/14.0/11.3/8.5	240	20.8/17.1/13.8/10.4	270	60	3UG73 ✓	28.0
3.7/3.1/2.5/1.8	12.6/10.6/8.5/6.1	208	17.8/14.9/10.4/8.7				
5/4.1/3.3/2.5	17.1/14.0/11.3/8.5	208	20.8/17.1/13.8/10.4	270	60	3UG74 ✓	28.0

## Unit Heater Accessories

### DOWNBLOW LOUVER DIFFUSERS

Permit straight line air flow. Rectangular coverage. Can be turned in either direction.

### DOWNBLOW RADIAL DIFFUSERS

Increase floor coverage. Adjustable fins, in vertical mode, direct downward in tight pattern; at 45° angle, give up to 25% greater floor coverage, at low mounting heights.

### WALL-MOUNT SPST THERMOSTAT

Feature a dustproof SPDT mercury switch, an adjustable heat anticipator, and a concealed wall plate for 2-wire heating hookups. For 2-wire, 24 to 30VAC control of heating or cooling systems.

### SPDT HEAT RECOVERY THERMOSTAT

Controls fan only to move stratified warm air. Use in addition to built-in or wall-mount thermostats. For QMark and Dayton unit heaters.

### MOUNTING BRACKETS

For horizontal-blow mounting only on wall or ceiling. Heater mount adjustable to allow control of air direction.

### BUILT-IN SPST THERMOSTAT

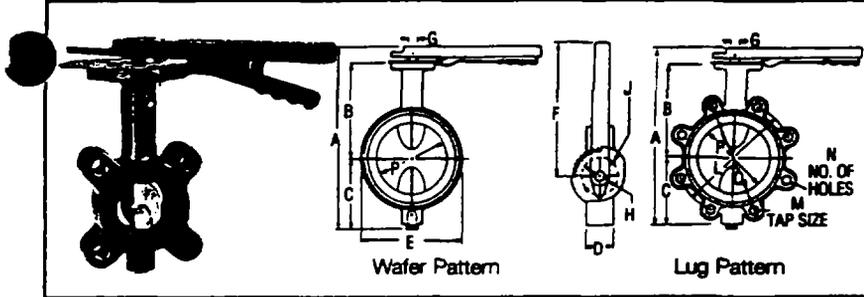
Specially designed with an internal thermostat.

EXTENDED WARRANTY AVAILABLE



# Series MBV Butterfly Valves

Low Cost, Lever Operated, Lug or Wafer Pattern, 200 psig, Memory Stop.



Size	2"	2-1/2"	3"	4"	5"	6"	8"	10"	12"
A	9.38	10.19	10.69	13.00	14.00	15.19	17.75	20.50	23.50
B	5.38	5.94	6.00	7.00	7.56	7.94	9.19	10.50	12.06
C	3.00	3.25	3.69	4.81	5.25	5.88	6.81	8.38	9.81
D	1.75	1.88	1.88	2.13	2.25	2.25	2.50	2.81	3.13
E	4.00	4.75	5.25	6.13	7.50	8.50	10.63	12.50	14.75
F	8.00	8.00	8.00	11.00	11.00	11.00	16.00	16.00	16.00
G	0.56	0.56	0.56	0.69	0.69	0.81	0.94	1.12	1.25
H	3.25	3.25	3.25	3.25	3.25	3.25	4.75	4.75	4.75
J	0.27	0.27	0.27	0.27	0.27	0.27	0.56	0.56	0.56
L	4.75	5.50	6.00	7.50	8.50	9.50	11.75	14.25	17.00
M-Thread	5/8-11	5/8-11	5/8-11	5/8-11	3/4-10	3/4-10	3/4-10	7/8-9	7/8-9
N-Holes	4	4	4	4	4	4	4	4	4
P	2	2.5	3	4	5	6	8	10	12
Q	6.00	7.00	7.50	9.00	10.00	11.00	13.50	16.00	19.00

Series MBV Butterfly Valves offer high performance at an economical price. Rated to 200 psig, the Series MBV is ideal for Commercial, HVAC and Industrial applications. Standard features include a Bronze alloy disc and EPDM or Buna-N seats for compatibility with a wide range of media. The 416 SS two-piece stem design provides strength while allowing a thinner disc profile resulting in higher Cv's. Extended neck provides clearance for up to 29 of insulation. 10 position locking handle sets the valve in 10° increments, while the memory stop lets you set the valve in the same position each time. Both lug and wafer designs fit ANSI CL125/150 flanges.

### OPERATING TORQUE VALUES (in-lbs.)

Size	0 psi Wet	0 psi Dry	100 psi Wet	100 psi Dry	200 psi Wet	200 psi Dry
2"	130	175	160	220	190	250
2 1/2"	150	200	180	250	225	300
3"	200	275	260	350	300	400
4"	330	450	420	550	450	600
5"	375	500	620	825	675	900
6"	675	900	900	1200	1100	1450
8"	900	1200	1200	1600	1500	2000
10"	1900	2500	2250	3000	2900	3800
12"	2400	3200	3400	4500	4500	6000

### SPECIFICATIONS

Size: 2" thru 12"  
 Material: Body - Cast Iron. Disc - Bronze (std); Nickel coated Ductile Iron (optional); 316 SS (optional).

Liner - EPDM, Buna-N, Viton®.  
 Bearings - Oil impregnated Bronze  
 Pressure Limits: 200 psi  
 Temperature Limits: Buna-N - 180°F (82°C); EPDM - 250°F (121°C); Viton® - 300°F (149°C)

### Cv Values vs % Open

	30%	40%	50%	60%	70%	100%
2"	14	25	43	60	87	130
2 1/2"	21	36	63	87	127	190
3"	39	68	119	166	241	360
4"	71	123	214	300	435	650
5"	154	266	462	644	938	1400
6"	209	361	627	875	1273	1900
8"	363	627	1089	1518	2200	3300
10"	550	950	1650	2300	3350	5000
12"	825	1425	2475	3450	5025	7500

### POPULAR MODELS

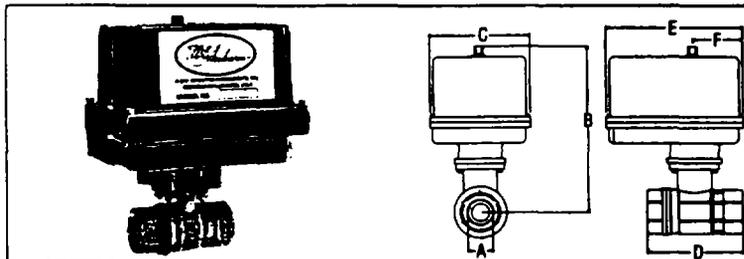
Size	Liner	Model	Size	Liner	Model
2"	BUNA-N	MBVL1102	5"	BUNA-N	MBVW1105
	EPDM	MBVL1202		EPDM	MBVW1205
	BUNA-N	MBVW1102		BUNA-N	MBVW1106
2 1/2"	BUNA-N	MBVW1202	6"	BUNA-N	MBVW1206
	EPDM	MBVW1225		EPDM	MBVW1206
	BUNA-N	MBVW1125		BUNA-N	MBVW1106
3"	BUNA-N	MBVW1225	8"	EPDM	MBVW1206
	EPDM	MBVW1103		BUNA-N	MBVW1108
	BUNA-N	MBVW1103		EPDM	MBVW1208
4"	EPDM	MBVW1203	10"	BUNA-N	MBVW1108
	BUNA-N	MBVL1103		EPDM	MBVW1208
	EPDM	MBVL1203		BUNA-N	MBVW1110
5"	BUNA-N	MBVL1104	12"	EPDM	MBVW1210
	EPDM	MBVL1204		BUNA-N	MBVW1110
	BUNA-N	MBVW1104		EPDM	MBVW1210
6"	EPDM	MBVW1204	12"	BUNA-N	MBVW1112
	BUNA-N	MBVW1104		EPDM	MBVW1212
	EPDM	MBVW1204		BUNA-N	MBVW1112
8"	BUNA-N	MBVL1105	12"	EPDM	MBVW1212
	EPDM	MBVL1205		BUNA-N	MBVW1112
	BUNA-N	MBVW1105		EPDM	MBVW1212

MBVL1102 L - Lug Pattern W - Wafer Pattern



# Series ABV Automated Ball Valve

Full Port, Forged Brass Construction, 600 psig (41 Bar), 320°F (160°C)  
 Direct Mount, Two Position or Modulating Electric Actuator



### DIMENSIONS

	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"
A	6.130	6.199	6.574	6.700	8.291	8.623	9.177	9.811
B	4.000	4.000	4.000	4.000	4.215	4.215	4.215	4.215
C	2.638	2.980	3.350	3.657	4.126	4.805	6.498	7.402
D	5.630	5.630	5.630	5.630	5.630	6.880	6.880	6.880
E	2.310	2.310	2.310	2.310	2.430	2.430	2.430	2.430
F	15	25	35	46	80	110	310	360

The Series ABV combines a durable full port, forged brass ball valve with a Nema 4 electric actuator to provide a compact, low cost, automated package. The brass ball valve utilizes PTFE seats and body seals for broad chemical compatibility and bubble-tight shutoff. Double o-ring stem seals provide leak free operation without the need for adjustment. Chrome plated brass ball reduces friction allowing for a lower torque actuator. Full port design offers high Cv's with minimal pressure drop. ISO mounting pad allows direct mounting of electric actuator. Select from 115 VAC, two-position actuator for open/close control, or provide a 4-20 mA control signal for precise modulating. Actuator features standard manual override, in case of power loss.

Suggested Specification: Ball valve shall be forged brass, with chrome plated brass ball. Design shall be two-piece, full port with PTFE seats and body seals. Stem seal shall incorporate double o-ring design. Valve shall be operated by direct mounted (115VAC)(24VAC)(220VAC) electric actuator. Actuator shall provide (two-position)(modulating) control. Automated ball valve shall be W.E. Anderson Model \_\_\_\_\_.

### SPECIFICATIONS

Size: 1/2" - 3"  
 Material: Valve - Body - Brass;  
 Ball - Brass, Chrome Plated;  
 Seats, Seals - Teflon®; O-rings - Viton®  
 Actuator - Housing - Aluminum  
 Pressure Limits: 600 psig (41 bar) (Water, Oil, Gas)

Temperature Limits: 320°F (160°C) - Valve; 150°F (66°C) - Actuator  
 Supply: 115VAC/60Hz/1ph  
 Switch Ratings: 15A 1/2 HP 125/250VAC, .5A 125VDC  
 Cycle Time: 5 sec/90°  
 Control Input: 4-20 mA  
 Enclosure: NEMA 4 (NEMA 7 optional - consult factory)

### STOCKED MODELS in bold

Size	Sec./90°	Two Position	Modulating
1/2"	2.5	<b>ABV100</b>	ABV110
3/4"	2.5	<b>ABV101</b>	ABV111
1"	2.5	<b>ABV102</b>	ABV112
1 1/4"	2.5	<b>ABV103</b>	ABV113
1 1/2"	5	<b>ABV104</b>	ABV114
2"	5	<b>ABV105</b>	ABV115
2 1/2"	5	<b>ABV106</b>	ABV116
3"	5	<b>ABV107</b>	ABV117

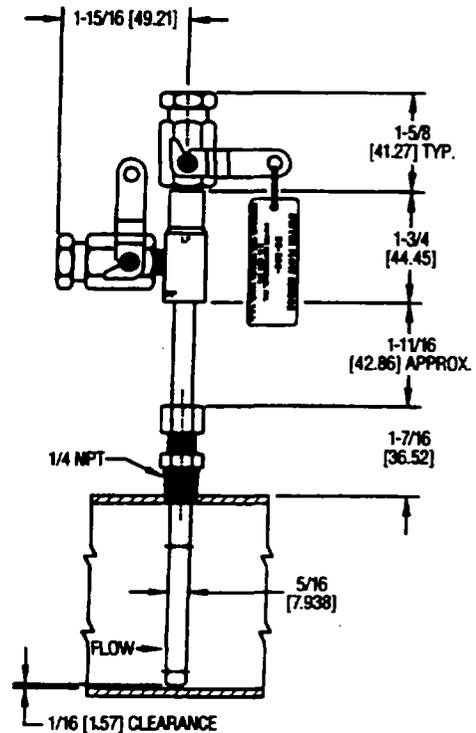
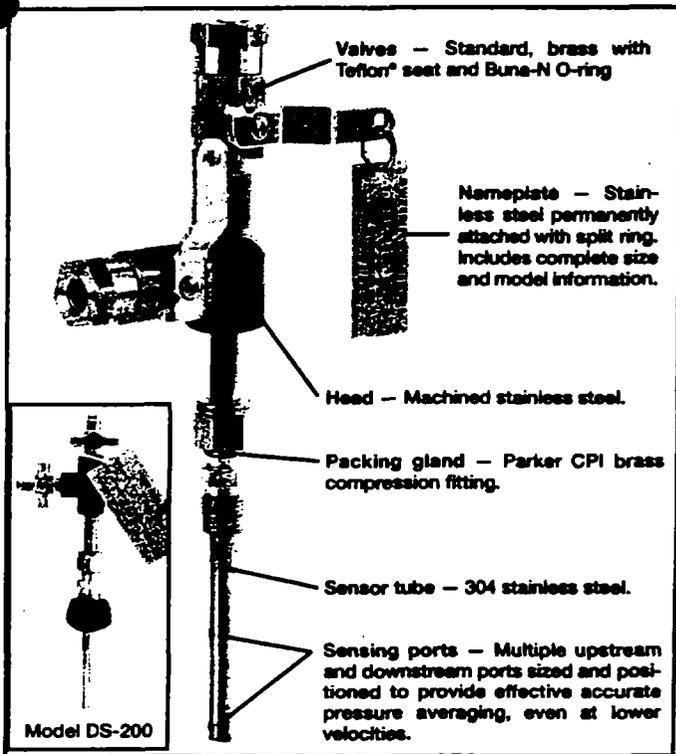


Series  
DS

# In-Line Flow Sensors

Use with the Dwyer Differential Pressure Gages or Transmitters

Air Velocity



Dwyer Flow Sensors are averaging pitot tubes that provide accurate and convenient flow rate sensing for schedule 40 pipe. When purchased with a Dwyer Capsuhelic® differential pressure gage of appropriate range, the result is a flow indicating system delivered off the shelf at an economical price.

Pitot tubes have been used in flow measurement for years. Conventional pitot tubes sense velocity pressure at only one point in the flowing stream. Therefore, a series of measurements must be taken across the stream to obtain a meaningful average flow rate. The Dwyer flow sensor eliminates the need for "traversing" the flowing stream because of its multiple sensing points and built-in averaging capability.

Series DS-200 models are available in ten insertion lengths from 1" - 10". Operation is similar to DS-300 units. Basic differences are the multi-turn shut-off valves, 3/8" NPT mounting and installed 1/4" SAE 45° flared pressure connections.

Dwyer Series DS-300 flow sensors are designed to be inserted in the pipeline through a compression fitting. They are furnished with instrument shut-off valves on both pressure connections. Valves are fitted with 1/8" female NPT connections. Accessories include adapters with 1/4" SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic kit. Standard valves are rated at 200 psig (13.7 bar) and 200°F (93.3°C). Where valves are not required, they can be omitted at reduced cost. Series DS-300 flow sensors are available for pipe sizes from 1" to 10". If replacing a DS-200 flow sensor or using an A-160 thredolet with a DS-300, an optional 1/4" x 3/8" bushing, P/N A-161 is required.

DS-400 Averaging Flow Sensors are quality constructed from extra strong 3/4" dia. stainless steel to resist increased forces encountered at higher flow rates with both air and water. This extra strength also allows them to be made in longer insertion lengths up to 24 inches (61 cm). All models include convenient and quick-acting quarter-turn ball valves to isolate the sensor for zeroing. Process connections to the valve assembly are

1/8" female NPT. A pair of 1/8" NPT x 1/4" SAE 45° flared adapters are included, compatible with hoses used in the Model A-471 Portable Capsuhelic® Gage Kit. Supplied solid brass mounting adapter has a 3/4" dia. compression fitting to lock in required insertion length and a 3/4" male NPT thread for mounting in a thred-o-let (not included).

### STOCKED MODELS in bold

— Select model with suffix which matches pipe size

DS-200-1".....	DS-300-1".....
DS-200-1 1/4".....	DS-300-1 1/4".....
DS-200-1 1/2".....	DS-300-1 1/2".....
DS-200-2".....	DS-300-2".....
DS-200-2 1/2".....	DS-300-2 1/2".....
DS-200-3".....	DS-300-3".....
DS-200-4".....	DS-300-4".....
DS-200-6".....	<b>DS-300-6".....</b>
DS-200-8".....	DS-300-8".....
DS-200-10".....	DS-300-10".....

DS-400-6".....
DS-400-8".....
DS-400-10".....
DS-400-12".....
DS-400-14".....
DS-400-16".....
DS-400-18".....
DS-400-20".....
DS-400-24".....

### Options and Accessories

A-160 Thredolet, X" NPT, forged steel, 3000 psi.....
A-161 Brass Bushing, X" x X".....
DS-200-VK Series DS Flow Sensors Valve Kit.....
Less Valves (DS-300) To order, add suffix -LV.....

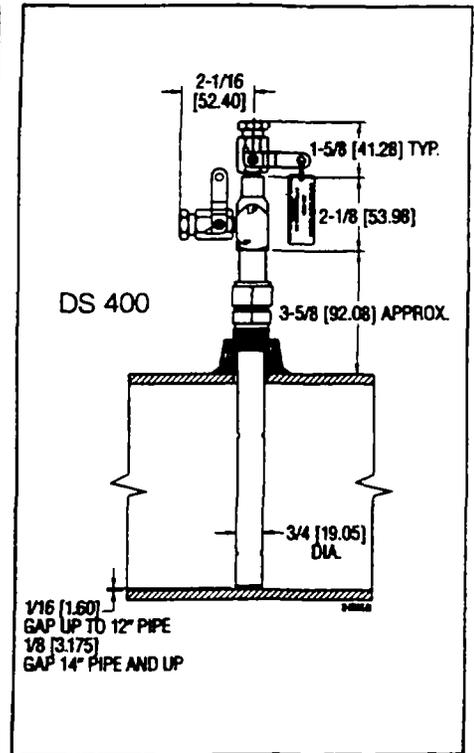
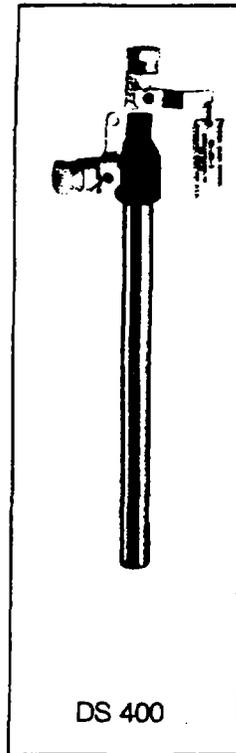
# How To Order

Merely determine the pipe size into which the flow sensor will be mounted and designate the size as a suffix to Model DS-300. For example, a flow sensor to be mounted in a 2" pipe would be a Model No. DS-300-2".

For non-critical water and air flow monitoring applications, the chart below can be utilized for ordering a stock Capsuhelic® differential pressure gage for use with the DS-300 flow sensor. Simply locate the maximum flow rate for the media being measured under the appropriate pipe size and read the Capsuhelic® gage range in inches of water column to the left. The DS-300 sensor is supplied with installation and operating instructions, Bulletin F-50. It also includes complete flow conversion information for the three media conditions shown in the chart below. This information enables the user to create a complete differential pressure to flow rate conversion table for the sensor and differential pressure gage employed. Both the Dwyer Capsuhelic® gage and flow sensor feature excellent repeatability so, once the desired flow rate is determined, deviation from that flow in quantitative measure can be easily determined. You may wish to order the adjustable signal flag option for the Capsuhelic® gage to provide an easily identified reference point for the proper flow.

Capsuhelic® gages with special ranges and/or direct reading scales in appropriate flow units are available on special order for more critical applications. Customer supplied data for the full scale flow (quantity and units) is required along with the differential pressure reading at that full flow figure. Prior to ordering a special Capsuhelic® differential pressure gage for flow read-out, we recommend you request Bulletin F-50 to obtain complete data on converting flow rates of various media to the sensor differential pressure output. With this bulletin and after making a few simple calculations, the exact range gage required can easily be determined.

## Large 3/4 Inch Diameter for Extra Strength in Lengths to 24 Inches

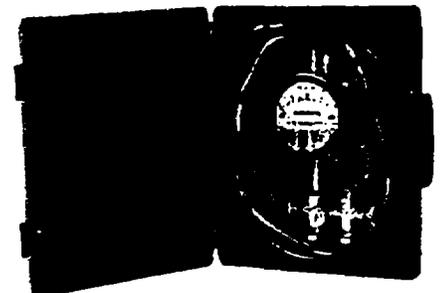


GAGE RANGE (IN. W.C.)	MEDIA @ 70°F	FULL RANGE FLOWS BY PIPE SIZE (APPROXIMATE)									
		1"	1 1/2"	2"	2 1/2"	3"	4"	6"	8"	10"	12"
2	Water (GPM)	4.8	8.3	11.5	20.5	30	49	86	205	350	560
	Air @ 14.7 PSIA (SCFM)	19.0	33.0	42.0	65.0	113	183	330	760	1340	2130
	Air @ 100 PSIG (SCFM)	50.0	90.5	120.0	210.0	325	510	920	2050	3600	6000
5	Water (GPM)	7.7	14.0	18.0	34.0	47	78	138	320	560	890
	Air @ 14.7 PSIA (SCFM)	30.0	51.0	66.0	118.0	178	289	510	1200	2150	3400
	Air @ 100 PSIG (SCFM)	83.0	142.0	190.0	340.0	610	820	1600	3300	5700	10000
10	Water (GPM)	11.0	19.0	25.5	45.5	67	110	195	450	800	1260
	Air @ 14.7 PSIA (SCFM)	41.0	72.0	93.0	163.0	250	410	725	1690	3040	4860
	Air @ 100 PSIG (SCFM)	120.0	205.0	275.0	470.0	740	1100	2000	4600	8100	15000
25	Water (GPM)	18.0	32.0	40.5	72.0	108	173	310	720	1250	2000
	Air @ 14.7 PSIA (SCFM)	63.0	112.0	155.0	255.0	390	640	1130	2630	4860	7700
	Air @ 100 PSIG (SCFM)	185.0	325.0	430.0	760.0	1200	1800	3300	7200	13000	22000
50	Water (GPM)	25.0	44.0	57.5	100.0	152	247	435	1000	1800	
	Air @ 14.7 PSIA (SCFM)	90.0	161.0	205.0	360.0	560	900	1600	3700	6400	
	Air @ 100 PSIG (SCFM)	260.0	460.0	620.0	1050.0	1700	2600	4600	10000	18500	
100	Water (GPM)	36.5	62.0	82.0	142.0	220	350	620	1500		
	Air @ 14.7 PSIA (SCFM)	135.0	230.0	300.0	505.0	800	1290	2290	5000		
	Air @ 100 PSIG (SCFM)	370.0	660.0	870.0	1500.0	2300	3600	6500	15000		

## Model A-471 Portable Kit

The Dwyer Series 4000 Capsuhelic® differential pressure gage is ideally suited for use as a read-out device with the DS-300 Flow Sensors. The gage may be used on system pressures of up to 500 PSIG even when the flow sensor differential pressure to be read is less than 0.5" w.c. With accuracy of ±3% of full scale, the Capsuhelic® gage can be used in ambient temperatures from 32°F to 200°F. Zero and range adjustments are made from outside the gage. The standard gage with a die cast aluminum housing can be used with the flow sensor for air or oil applications. For water flow measurements, the optional forged brass housing should be specified. The Capsuhelic gage may be panel or surface mounted and permanently plumbed to the flow sensor if desired. The optional A-610 pipe mounting bracket allows the gage to be easily attached to any 1/4" - 2" horizontal or vertical pipe.

For portable operation, the A-471 Capsuhelic Portable Gage Kit is available complete with tough polypropylene carrying case, mounting bracket, 3-way manifold valve, two 10' high pressure hoses, and all necessary fittings. See pages 7 and 8 for complete information on the Capsuhelic gage . . . . .

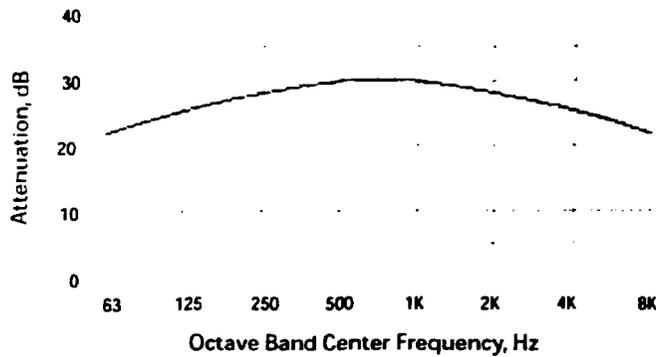


CAPSUHELIC GAGE SHOWN INSTALLED IN A-471 PORTABLE KIT

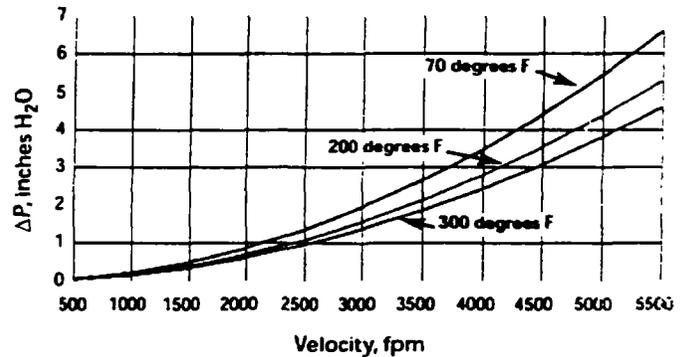
# SPECIFICATIONS

## CB 'LIL HUMMER' Compact Blower Silencer

ATTENUATION CURVE, TYPICAL

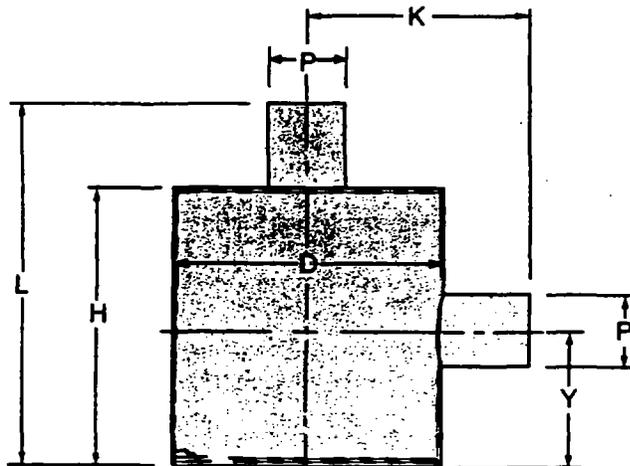
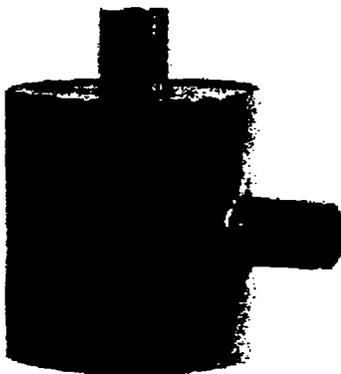


PRESSURE DROP



### MODELS, DIMENSIONS & WEIGHTS

MODEL	P (nom.)	D	L	H	Y	K	WT.	CFM CAP
CB-2	2	8.00	11.00	8.00	4.00	7.00	15	120
CB-2.5	2.5	8.00	12.50	9.50	4.75	7.00	25	187
CB-3	3	12.00	13.50	10.50	5.25	9.00	35	270
CB-4	4	12.00	18.00	15.00	7.50	9.00	45	480
CB-5	5	16.00	20.00	17.00	8.50	11.00	70	750
CB-6	6	16.00	26.00	23.00	11.50	11.00	85	1080
CB-8	8	24.00	31.00	27.50	13.75	15.50	170	1920
CB-10	10	30.00	39.00	35.50	17.75	18.50	275	3000
CB-12	12	34.00	43.00	39.50	19.75	20.50	355	4320



NOTES:  
1. Finish: Shop coat primer (88-0102).



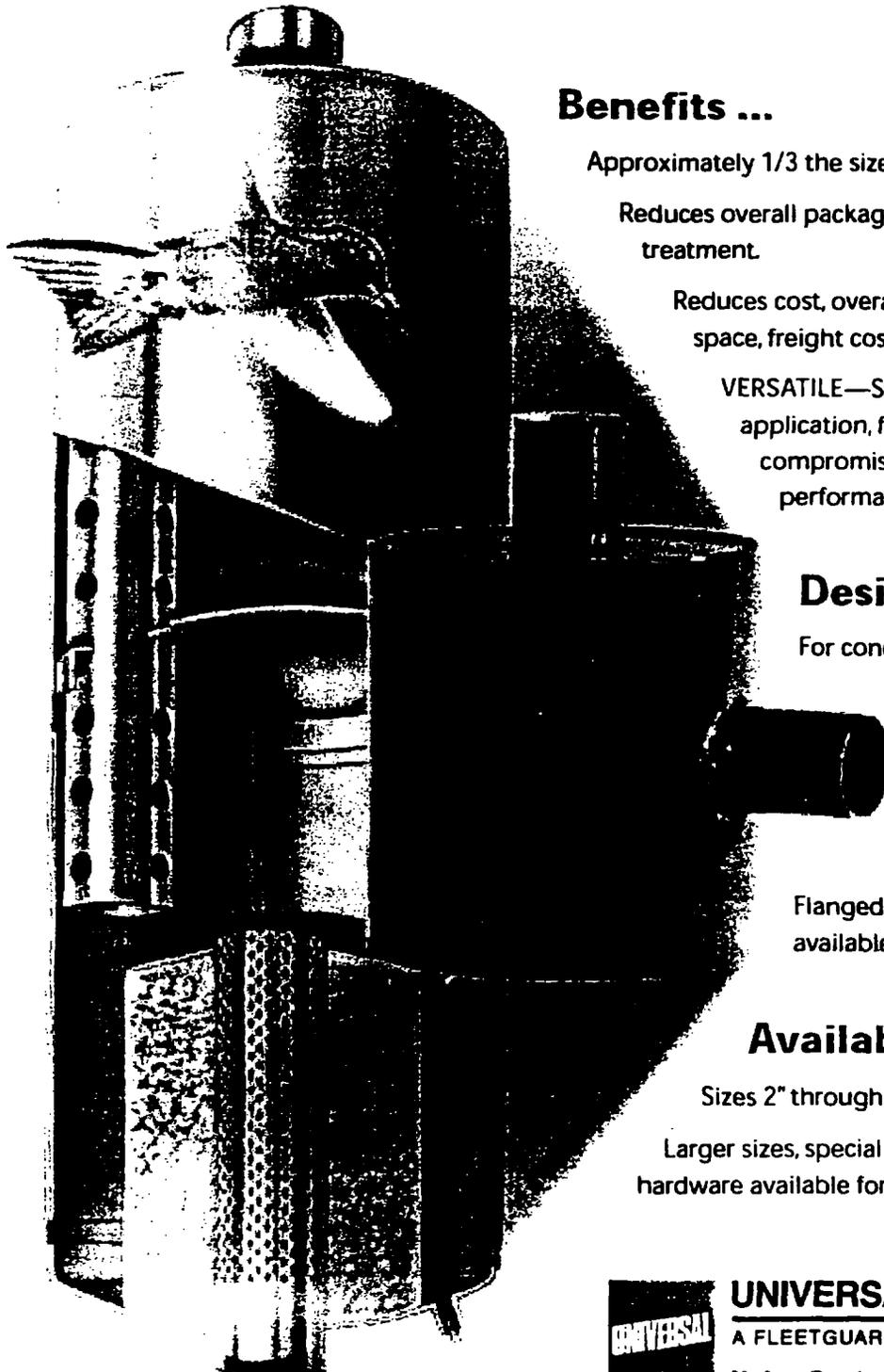
### UNIVERSAL SILENCER

A FLEETGUARD/NELSON COMPANY  
P. O. Box 411, Stoughton, Wisconsin 53589  
608-873-4272 Fax 608-873-4298

# CB 'LIL HUMMER™

## Compact Blower Silencer

INLET OR DISCHARGE SILENCER  
FOR POSITIVE DISPLACEMENT BLOWERS



### Benefits ...

Approximately 1/3 the size of conventional blower silencers.

Reduces overall package noise without further acoustic treatment.

Reduces cost, overall package size, weight, storage space, freight cost, and damage.

VERSATILE—Suitable for inlet or discharge application, forward or reverse flow, all without compromising acoustic or pressure drop performance.

### Design Advantages ...

For conditions up to 15 PSIG.

Internal pack material suitable for temperatures up to 325 degrees F.

Standard connections, plain nominal pipe ends.

Flanged or threaded connections available.

### Availability ...

Sizes 2" through 12" stock.

Larger sizes, special connections, and mounting hardware available for fast delivery.



**UNIVERSAL SILENCER**

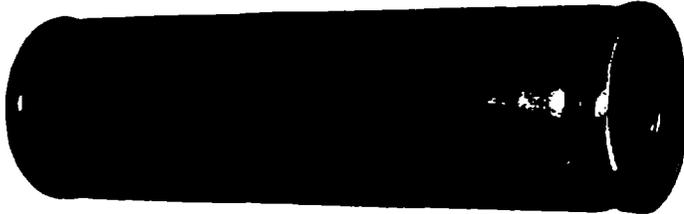
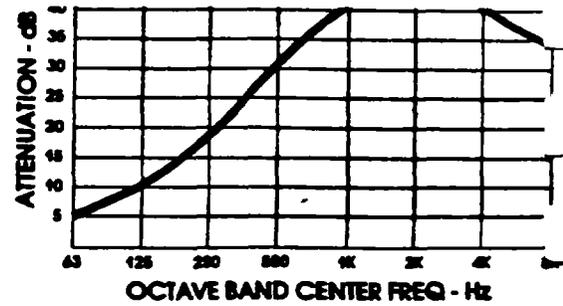
A FLEETGUARD/NELSON COMPANY

Noise Control and Air Filtration

# Specifications U5 Series

Straight-Through  
Silencer

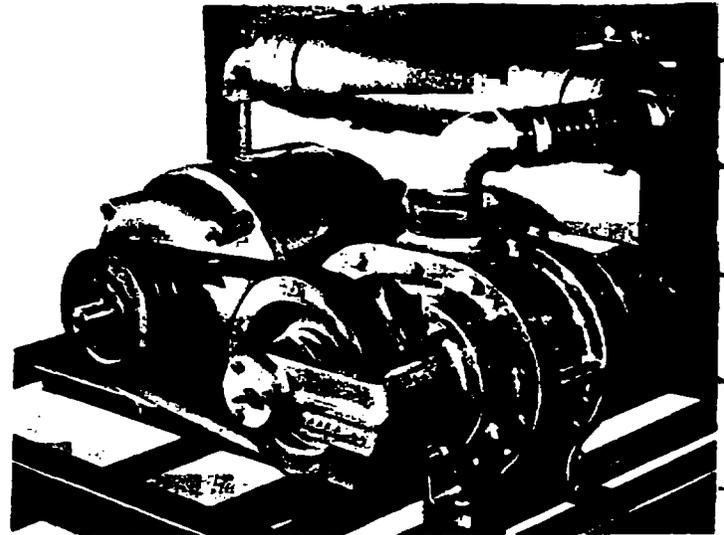
NOTE: U5 Series Standard Paint and Acoustical Packing are suitable for 325°F.



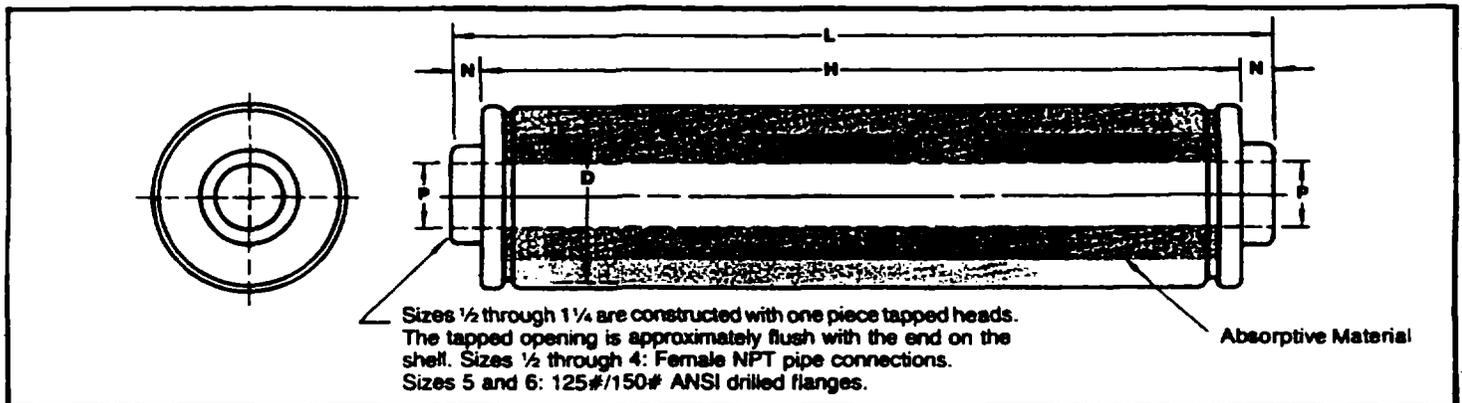
The U5 series is a premium, straight-through, absorptive silencer. It provides excellent noise attenuation due to its very high length to diameter ratio. It is especially well suited for inlet service on small rotary positive or centrifugal blowers or the discharge of vacuum pumps. Mild steel construction with enamel paint.

### Common Applications:

- Blower inlet
- Vacuum Pump discharge
- Air Valves and cylinders
- Small low pressure vents
- Any high frequency noise source



Typical installation shows U5 silencer on inlet of small rotary positive blower.



MODEL	P	D	L	N	H	WGT.
U5-1/2	1/2	3/4	8	—	8	2
U5-3/4	3/4	3/4	11	—	11	3
U5-1	1	3/4	14	—	14	3
U5-1 1/4	1 1/4	3/4	16	—	16	4
U5-1 1/2	1 1/2	4/4	19 1/4	1/2	18 1/4	6
U5-2	2	5/4	26	1/2	25	10
U5-2 1/2	2 1/2	6/4	33 1/2	1/2	32 1/2	15
U5-3	3	6/4	36 1/2	1/2	35 1/2	20
U5-4	4	8	48 1/4	1/2	48 1/4	40
U5-5	5	10	57	3	51	60
U5-6	6	12	63	3	57	100

Dimensions in Inches - Weight in Pounds



# UNIVERSAL SILENCER

A FLEETGUARD/NELSON COMPANY  
P.O. Box 411, Stoughton, Wisconsin 53589  
800-873-4272 Fax: 800-873-4278

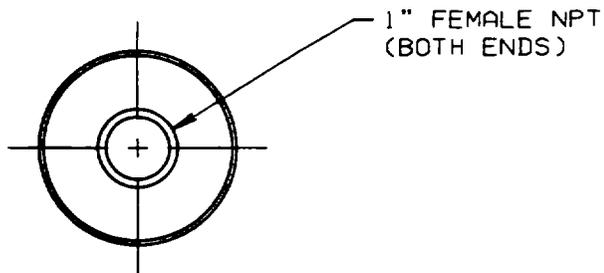
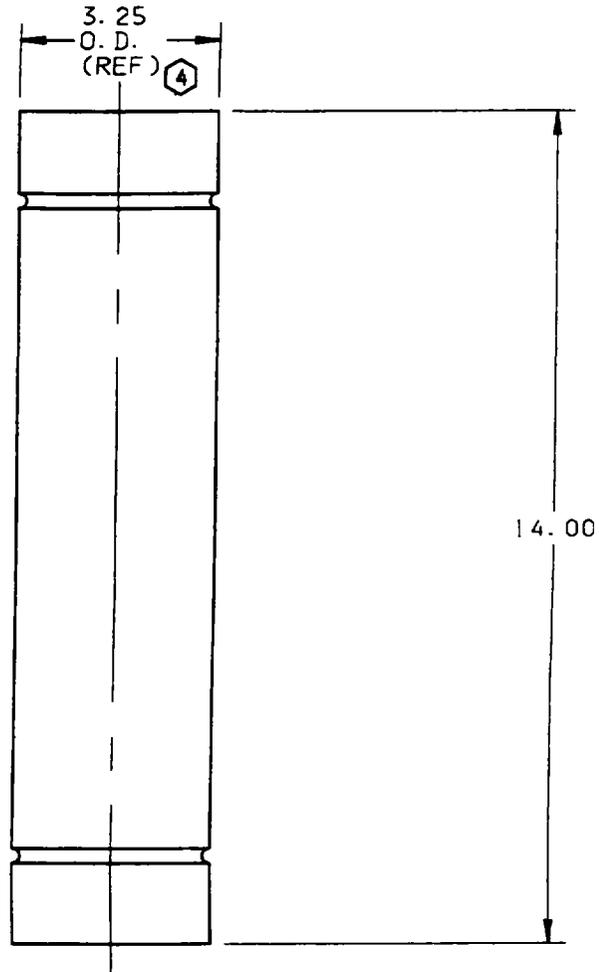
## STANDARD U5-1 ABSORPTIVE TYPE SILENCER

DATE 06-15-98

SHEET OF

SCALE NTS

NO.	4	ADDED (REF) TO NON-CRITICAL DIMS.	TAH	DO
	3	REDRAWN	12-17-00	12-17-00
REVISION			6-15-98	DY
			DRAWN	PPD'D



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DIMENSIONAL DRAWING NO.  
11-101-AA

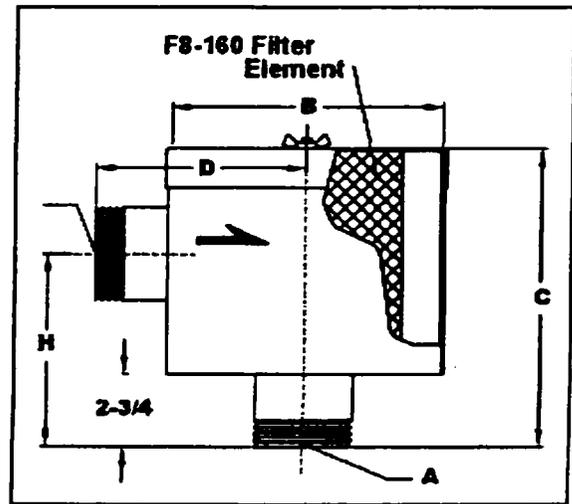
DIMENSIONS CERTIFIED FOR:	
P.O. NO:	
U.S. S.O. NO:	
BY	

REV.	APPROX WT 3 LBS	MATERIAL STEEL	DRAWN DY	DIMENSIONAL DRAWING NO.	REV.
4	FINISH 88-1085 BLUE ENAMEL		CHECK DO 6-15-98	11-101-AA	4

# Series F75

## INLINE AIR FILTERS F75 VACUUM SERVICE ONLY

The Series F75 Inline Filter is a cost-effective alternative to the F65 Series Inline Filter. The F75 is designed to be mounted in the inlet piping or vacuum system piping for vacuum blowers, engines or compressors. The housing is rated to 16 inches Hg vacuum. The filtering element is polyurethane foam with a stainless steel center core. The filter removes 98% of all particles 10 micron size or larger.



Model	A	B	C	D	H
F75 - 2	2 NPT	10	11 1/4	7 5/8	7 1/4
F75 - 2 1/2	2 1/2 NPT	10	11 1/4	7 5/8	7 1/4
F75 - 3	3 NPT	10	11 1/4	7 5/8	7 1/4
F75 - 4	4 NPT	12	11 1/4	8 3/8	7 1/4

Model	WEIGHT	REPLACEMENT ELEMENT NUMBER
F75 - 2	17	F8-160
F75 - 2 1/2	20	F8-160
F75 - 3	20	F8-160
F75 - 4	26	F8-160

**tyco**

## KUNKLE

### Features

- Large nozzle design provides high capacity.
- Flat bronze valve seats are lapped for optimum performance.
- Warn ring offers easy adjustability for precise opening with minimum pre-open or simmer and exact blowdown control.
- Pivot between disc and spring corrects misalignment and compensates for spring side thrust.

### Model Descriptions

- Model 337 has 'pull-ring' lift device for easy manual testing.
- Every valve is 100% tested/inspected for pressure setting, blowdown and leakage.
- All adjustments are factory sealed to prevent tampering or disassembly.

### Option

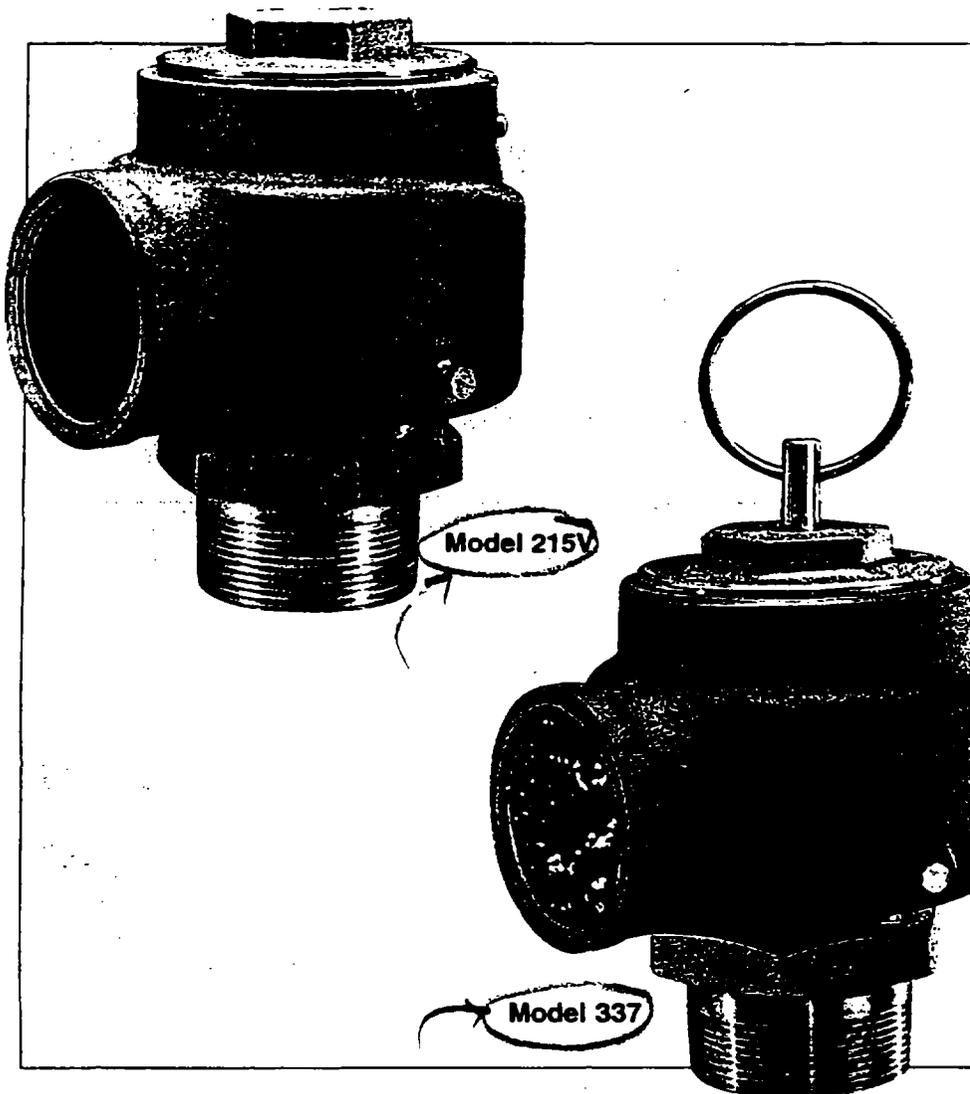
- SS trim. (nozzle and disc) (Variation 03)

### Applications

- Protection of low to medium pressure high volume blowers, compressors and pneumatic conveying systems.
- Bulk hauling trailers/equipment.
- Light gauge tanks.
- Protection of high volume vacuum pumps and conveying systems.

## Models 215V and 337

Model 215V is Non-code Vacuum and Model 337 is ASME Section VIII, Air/Gas Vacuum, 'UV' National Board Certified, Safety Valves



### Vacuum Limits

#### Model 215V:

2-inch HG  
to 29-inch HG  
[67.7 to 982 mbarg]  
-20° to 406°F [-29° to 208°C]

### Pressure and Temperature Limits

#### Model 337:

1 to 60 psig [0.07 to 4.1 barg]  
-20° to 406°F [-29° to 208°C]

**Models 215V and 337**

**Model 215V**

<b>Non-code Vacuum Air (SCFM) - Flow Coefficient</b>			
Relief Set (in, HG)	Valve Inlet and Outlet Size		
	2" Orifice Area, in <sup>2</sup> 1.84	2 1/2" Orifice Area, in <sup>2</sup> 2.79	3" Orifice Area, in <sup>2</sup> 4.04
2	229	347	503
5	338	512	742
10	415	630	912
15	426	646	936
20	426	646	936

<b>Non-code Vacuum Air [Metric, Nm<sup>3</sup>/h]</b>			
Relief Set [mbarg]	Valve Inlet and Outlet Size		
	5.08 cm Orifice Area [11.86 cm <sup>2</sup> ]	6.35 cm Orifice Area [17.97 cm <sup>2</sup> ]	7.62 cm Orifice Area [26.05 cm <sup>2</sup> ]
50	328	498	722
100	450	682	988
150	533	807	1170
200	593	899	1303
250	638	966	1400
300	669	1014	1470
350	690	1046	1516
400	701	1062	1540
450	704	1067	1546
500	704	1067	1546
550	704	1067	1546
600	704	1067	1546
650	704	1067	1546
700	704	1067	1546
750	704	1067	1546

**Model 337**

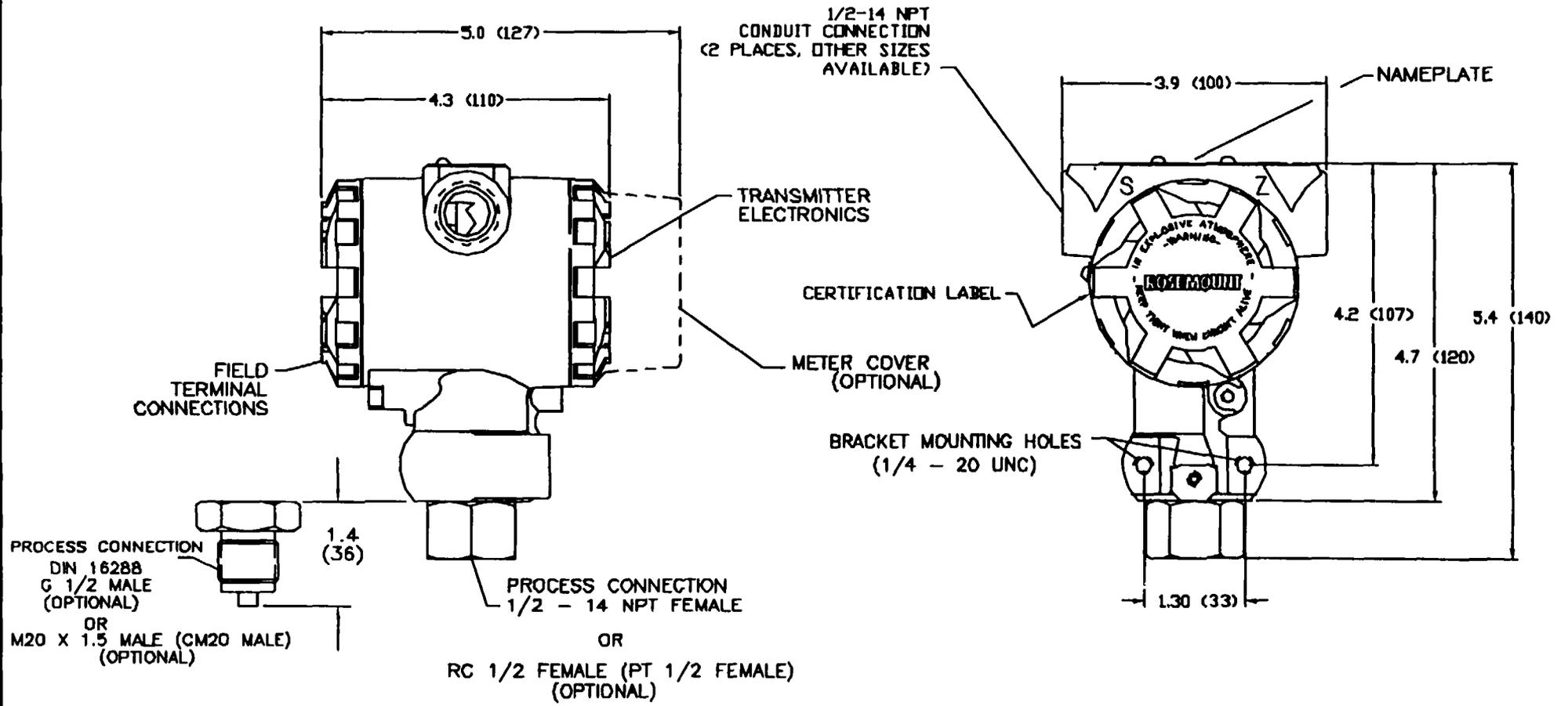
<b>Non-code<sup>1</sup> and ASME Section VIII Air (English, SCFM)</b>			
Set Pressure (psig)	Valve Inlet and Outlet Size		
	2"	2 1/2"	3"
1	240	364	527
5	531	805	1166
10	741	1124	1628
15	948	1436	2081
20	1092	1656	2399
25	1237	1875	2718
30	1382	2095	3036
35	1542	2337	3386
40	1701	2578	3736
45	1860	2820	4086
50	2020	3061	4436
55	2179	3303	4786
60	2338	3544	5136

<b>Non-code<sup>1</sup> and ASME Section VIII Air [Metric, Nm<sup>3</sup>/h]</b>			
Set Pressure [barg]	Valve Inlet and Outlet Size		
	50 mm	63 mm	80 mm
0.5	1049	1589	23
1.0	1457	2208	32
1.5	1888	2861	4147
2.0	2235	3387	4917
2.5	2613	3959	57
3.0	2995	4538	6579
3.5	3377	5117	7418
4.0	3760	5696	82

1. No code stamp or 'NB' on nameplate below 1.1 barg set.

1. No code stamp or 'NB' on nameplate below 15 psig set.

REVISIONS				
REV	DESCRIPTION	CHG.NO.	APP'D	DATE
ASB	UPDATE DRAWINGS TO TYPE 1 STANDARD	RTD161443D	NH.	12/18/02



*UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES (MM) *ALL DIMENSIONS ARE NOMINAL 	TYPE I		<b>ROSEMOUNT</b> INC. CHANHAMDEN, MINNESOTA	
	DR. JOHN ERSTROM APP'D. DRAWING APP'D. TAGGING APP'D. SPECIALS	12/18/02 12/18/02	TITLE DIMENSIONAL DRAWING FOR MODEL 2088S PRESSURE TRANSMITTERS	
		SIZE	FSCM.NO.	DRAWING NO.
		A	04274	02088-1035
		SCALE	NONE	WT.
				SHEET 1 OF 1

# ROSEMOUNT SPECIFICATIONS

## Model 2088 Absolute and Gage Pressure Transmitter

### 1. EQUIPMENT DESCRIPTION

- Two-wire, microprocessor-based absolute or gage pressure transmitter with analog or digital (smart) output.
- Small, lightweight design (2 lb [0.9 kg]) which allows for optional mounting bracket use.
- Modular electronics incorporating replaceable circuitry.

### 2. REFERENCES

- Material supplied under this specification shall be in conformance with:
  - National Electrical Code (NFPA 70) 501-5 by incorporating a two-compartment electronics housing for separation of the process medium and the electrical conduit.
  - National Electrical Manufacturer's Association (NEMA) standard number classification ICS6 "Enclosure for industrial controls and systems," 4X.
  - Factory Mutual (FM), Canadian Standards Association (CSA), CENELEC, SAA standards for explosion-proof enclosure and intrinsically safe electronic circuitry.
  - Japanese Industrial Standard (JIS) for explosion-proof enclosure.
- Manufacturer must be certified as meeting the requirements of ISO 9001.

### 3. ENVIRONMENTAL CONDITIONS

- The instrument selected shall be suitable for the following conditions:
  - Humidity: 0 to 100% relative humidity.
  - Ambient temperature limits: -40 to 185 °F (-40 to 85 °C).
- Transmitter shall have a dual-compartment housing with a moisture barrier totally isolating the electronic circuitry from the field wiring and calibration terminals.

### 4. PROCESS CONDITIONS

- Suitable for liquid, gas, and vapor service.
- Process temperature limits: -40 to 250 °F (-40 to 121 °C).
- Pressure limits: minimum of twice the upper range limit of the transmitter.

### 5. ELECTRICAL

- Transmitter shall be certified for use in hazardous areas by a recognized authority such as Factory Mutual.
- Electrical connections shall be ½-14 NPT, CM 20 or PG 13.5 conduit.
- Transmitter to be factory sealed; conduit seal not required to meet FM explosion-proof requirements.

### 6. POWER SUPPLY

- Transmitter shall operate on 10.5 to 36 V dc with no load (6-14 V dc for low power).

### 7. RANGES

- Ranges shall be available from 0-1 psi to 0-4,000 psi (0-6.89 kPa to 0-27.6 MPa)

### 8. OUTPUTS

- Outputs shall be a 4-20 mA dc digital HART protocol signal and a 4-20 mA analog signal (1-5 V dc for low power).
- Self diagnostics capability with downscale failure mode.
- Transmitter must have adjustable calibration to allow turn down of at least 10:1 or 20:1 for smart output.
- Zero and span adjustments shall be non-interactive with each other and also non-active during transmitter operation.

## 9. PERFORMANCE

- The transmitter shall meet the following performance criteria as a minimum:
  - Accuracy:  $\pm 0.25\%$  of calibrated span.
  - Ambient Temperature Effects (per 100 °F [55 °C]):

Temperature	Ranges between 0–3 and 0–4,000 psi (0–20.7 kPa to 0–27.6 MPa)	Ranges below 0–3 psi (0–20.7 kPa)
–40 to 0 °F (–40 to –18 °C)	$\pm(0.7\% \text{ URL} + 0.8\% \text{ Span})$	$\pm(1.3\% \text{ URL} + 0.5\% \text{ Span})$
0 to 140 °F (–18 to 60 °C)	$\pm(0.5\% \text{ URL} + 0.5\% \text{ Span})$	$\pm(1.0\% \text{ URL} + 0.5\% \text{ Span})$
140 to 185 °F (60 to 85 °C)	$\pm(0.7\% \text{ URL} + 0.8\% \text{ Span})$	$\pm(1.3\% \text{ URL} + 0.5\% \text{ Span})$

- Stability:  $\pm 0.10\%$  of upper range limit for 12 months for smart output.
- $\pm 0.25\%$  of upper range limit for 12 months for analog output.
- Vibration:  $\pm 0.1\%$  of upper range limit when subjected to 2 g (15–150 Hz) and 1 g (150–2000 Hz).
- Radio Frequency Interference:  $\pm 0.25\%$  of upper range limit from 20–1000 MHz at 30 V/m with leads in conduit.  $\pm 0.25\%$  of upper range limit at 10 V/m with unshielded twisted pair (no conduit).

## 10. OPTIONS

- The following options shall be available:
  - Digital indicating meter.
  - Remote diaphragm seals.
  - Mounting bracket.
  - Transient protection
  - Assembly to Model 306 Integral Manifold

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00815-0100-4690 Rev. BB 11/98

# ROSEMOUNT

**FISHER-ROSEMOUNT™ Managing The Process Better:**

## PVC Knife Gate Valves Full Port

- Designed for quick shut-off in low pressure or vacuum lines

Valterra gate valves are ideally suited for tank drains, wastewater control, septic systems, and other low pressure applications. White PVC bodies and stainless steel shafts are standard throughout. The 3" sliding gate is made of polypropylene, whereas the 4", 6", and 8" gates made of stainless steel. Seals are EPDM or comparable material. Our stock valves have Soc. x Soc. connections for Sch. 40 PVC pipe. All sizes can be rebuilt or resealed without removing the socket end connections.



PIPE SIZE SCH. 40	OVERALL LENGTH	MAX PSI	VALVE STOCK #
2"	3 1/2"	50	18255
3"	4 1/2"	20	18251
4"	5 1/2"	18	18252
6"	11 1/2"	18	18253
8"	13 1/2"	18	18254

## Knife Gate Valve Handle Extensions

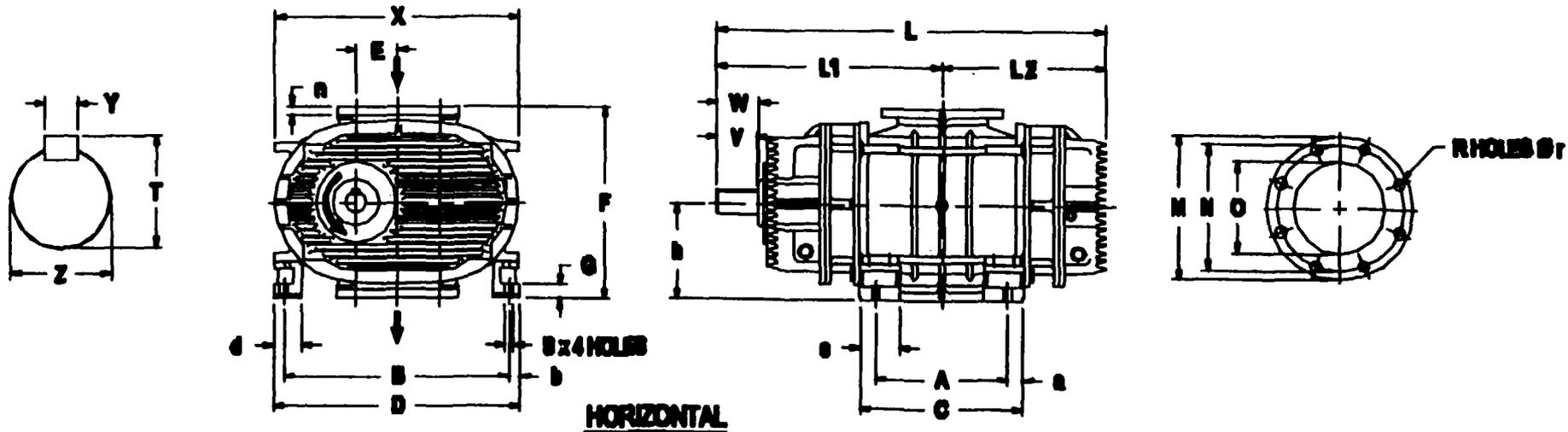
Stainless steel shafts are 1/4" with 1/4-20NC thread connections for valve sizes through 4" and 5/16" diameter with 5/16-18NC threads for 6" and 8" valves. If you want intermediate sizes you can cut standard length and re-thread one end.

### FOR VALVE SIZES 2" THROUGH 4"

EXTENSION LENGTH	STOCK #
36"	18264
48"	18265
72"	18266

### FOR VALVE SIZES 6" THROUGH 8"

EXTENSION LENGTH	STOCK #
36"	18267
48"	18268
72"	18269



1. METRIC DIMENSIONS ARE EXACT.
2. IMPERIAL DIMENSIONS ARE CONVERSION OF METRIC.
3. #22 ON INLET SIDE AND M20 ON DISCHARGE SIDE.
4. STANDARD CONFIGURATION SHOWN. OTHER CONFIGURATIONS AVAILABLE UPON REQUEST.

MODEL	A	a	B	b	C	D	d	E	e	F	G	h	L	L1	L2	n	S	V	W	X	Z	TOL.	T	Y	O	N	M	R	r	WEIGHT		
	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	Lbs
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	Kgs	
SNH806	4.92	1.36	15.55	1.08	7.64	17.72	2.26	2.66	2.72	14.57	0.79	7.28	25.24	15.00	10.24	0.79	0.71	2.95	3.15	16.73		+ 0.025										367
	125	34.5	395	27.5	194	450	57.5	67.5	69	370	20	185	641	381	260	20	18	75	80	425	38	+ 0.009	41	10	125	210	250	8	18	167		
SNH809	8.07	1.36	15.55	1.08	10.79	17.72	2.26	2.66	2.72	14.57	0.79	7.28	28.39	16.57	11.81	0.79	0.71	2.95	3.15	16.73		+ 0.025									416	
	205	34.5	395	27.5	274	450	57.5	67.5	69	370	20	185	721	421	300	20	18	75	80	425	38	+ 0.009	41	10	150	240	285	8	22	189		
SNH815	14.57	1.65	15.55	1.08	17.87	17.72	2.26	2.66	3.31	14.57	0.79	7.28	35.47	20.12	15.35	1.02	0.71	2.95	3.15	16.73		+ 0.025									537	
	370	42	395	27.5	454	450	57.5	67.5	84	370	20	185	901	511	390	26	18	75	80	425	38	+ 0.009	41	10	200	295	340	8	22	244		
SNH822	14.17	1.42	21.65	0.98	17.01	23.62	2.56	3.41	2.83	17.72	0.98	8.66	38.86	22.48	16.18	1.02	0.87	3.54	3.94	20.79		+ 0.025									957	
	360	36	550	25	432	600	65	86.5	72	450	25	225	982	571	411	26	22	90	100	528	50	+ 0.009	53.5	14	200	295	343	8	22	435		
SNH842	14.76	1.77	23.62	1.38	18.31	26.38	3.31	4.27	4.17	21.26	0.98	10.63	44.37	26.00	18.37	1.10	0.79	4.13	4.72	25.67		+ 0.030									1364	
	375	45	600	35	465	670	84	108.5	106	540	25	270	1127	660.5	466.5	28	20	105	120	652	65	+ 0.011	69	18	250	350	395	12	22	620		
SNH870	16.93	2.09	28.74	1.38	21.10	31.50	3.54	5.31	5.08	24.41	0.98	12.20	50.04	29.02	21.02	1.10	1.06	5.12	5.51	31.10		+ 0.030									2202	
	430	53	730	35	536	800	90	135	129	620	25	310	1271	737	534	28	27	130	140	790	70	+ 0.011	74.5	20	250	350	395	12	#3	1001		
SNH890	20.87	2.95	29.92	1.38	26.77	32.68	4.13	5.31	4.92	26.77	0.98	13.39	55.94	31.97	23.98	1.18	1.06	5.12	5.51	31.10		+ 0.030									2446	
	530	75	760	35	680	830	105	135	125	680	25	340	1421	812	609	30	27	130	140	790	70	+ 0.011	74.5	20	300	400	445	12	22	1112		
SNH8110	26.77	2.95	29.92	1.38	32.68	32.68	4.13	5.31	4.92	26.77	0.98	13.39	61.85	34.92	26.93	1.18	1.06	5.12	5.51	31.10		+ 0.030									2697	
	680	75	760	35	830	830	105	135	125	680	25	340	1571	887	684	30	27	130	140	790	70	+ 0.011	74.5	20	350	460	505	16	22	1226		

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**Hibon Inc.**

12835 COTE DE L'ESSE, BURNEL, Q.E., H3P 1B4  
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800 LEGION ROAD, UNIT 3, BURLINGTON, ONT. L7S 1T9  
 (416) 632-1111 FAX (416) 632-1112

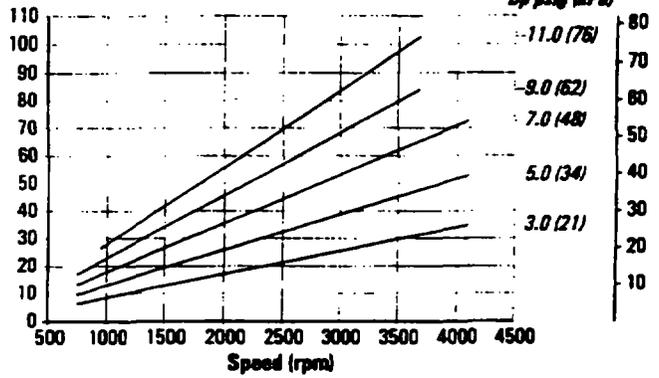
HIBON SNH SERIES BLOWER - OVERALL DIMENSIONS

# Pressure Operation

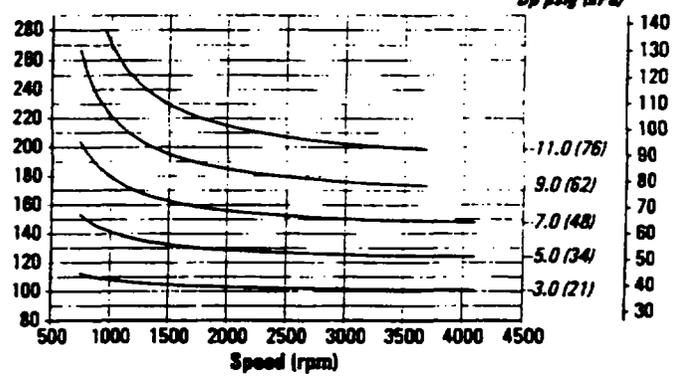
*Qvi* Inlet volume  
*Pabs* Blower shaft power  
*Ve* Displacement  
*Tref* Outlet temperature  
*Dp* Differential pressure  
*N* Speed

These curves are valid for inlet gas at 60 °F  
 and inlet pressure 14.70 psia  
 Molar mass : 28.8 g/mol ; Density : 1.2 kg/m<sup>3</sup>  
 Specific heat : 1.0 kJ/kgK ; Tolerance : +/- 10 %

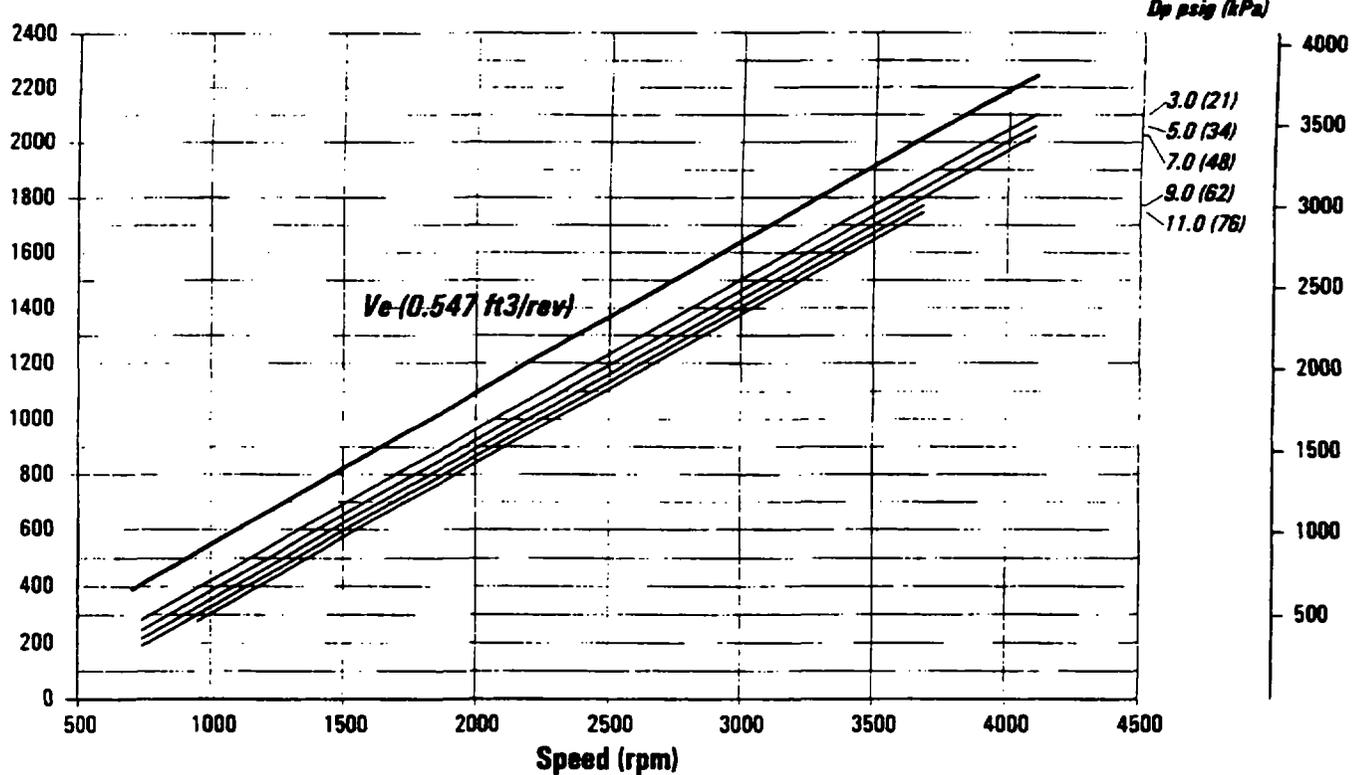
**BHP Power curves (Pabs)**



**°F Temperature curves (Tref)**



**CFM Flow curves (Qvi)**



Hibon Blower

**SNH/V 815 TRI-LOBE**

**hibon**

hibon inc.  
info@hibon-canada.com

R2-005	815P	04 C	XL
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08-99-v5.13



Nr.: Q12584R2

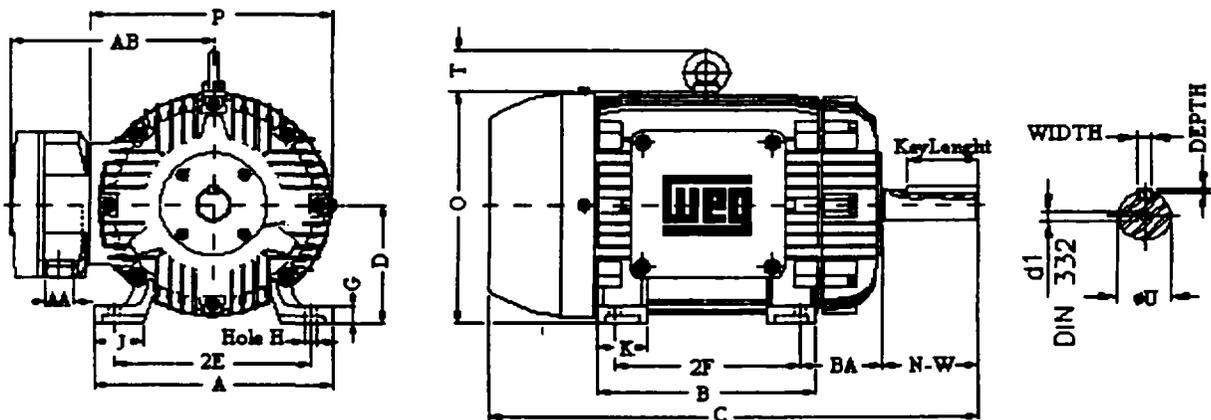
Date: 11 - Mar, 03

**DATA SHEET**

Customer: **Montgomery Watson/ACS SBPA**  
 Motor line: **EXPLOSION PROOF PREMIUM UL**

Rated Output	: 30.0 HP (cv)	Duty cycle	: S1															
Frame	: 286T	Altitude	: 1000 m.a.s.l															
Poles	: 4 Poles	Ambient temperature	: 40 °C															
Frequency	: 60 Hz	Degree of protection	: IP54															
Full load speed	: 1770 rpm	Slip	: 1.67 %															
Voltage	: 208-230/460 V	No load current	: 22.5/11.3 A															
Full load current	: 70.3/35.1 A	Locked rotor time	: 49 s															
Service factor	: 1.15	Moment of inertia	: 4.6827 sq.ft.lb															
Locked rotor amps	: 422/211 A	Approx. weight	: 463 lb															
Locked rotor current (I/In)	: 6.00 - Code F	Noise level	: 71 dB(A)															
Insulation class	: F	<table border="1"> <thead> <tr> <th colspan="3">Performance under load</th> </tr> <tr> <th>Load</th> <th>cos <math>\phi</math></th> <th>Efficiency(%)</th> </tr> </thead> <tbody> <tr> <td>100 %</td> <td>0.85</td> <td>92.4</td> </tr> <tr> <td>75 %</td> <td>0.83</td> <td>92.4</td> </tr> <tr> <td>50 %</td> <td>0.76</td> <td>91.0</td> </tr> </tbody> </table>		Performance under load			Load	cos $\phi$	Efficiency(%)	100 %	0.85	92.4	75 %	0.83	92.4	50 %	0.76	91.0
Performance under load																		
Load	cos $\phi$			Efficiency(%)														
100 %	0.85			92.4														
75 %	0.83			92.4														
50 %	0.76	91.0																
Temperature rise	: 80 K																	
Full load torque	: 87.8 ft.lb																	
Locked rotor torque	: 250 %																	
Breakdown torque	: 230 %																	
Design	: B																	
	Bearings	Regreasing int.	Grease amount															
D.E.	6311 C3	9500 h	18 g															
N.D.E.	6211-Z C3	9500 h	11 g															

NOTE:

**DRAWING AND DIMENSIONS**

2E	2F	H	BA	A	B	C	D
11.000	11.000	0.531	4.750	13.781	13.078	28.047	7.000
G	J	K	O	P	T	Width	Depth
1.109	3.156	2.953	14.047	14.093	2.515	0.500	0.250
key length	N-W	U	AB	AA	d1		
3.250	4.625	1.875	11.375	NPT 1/2"	A4		

Performed:  
Karen Mayes

Checked:

VERSION 3.1

\* Note: The values shown are subject to change without prior notice

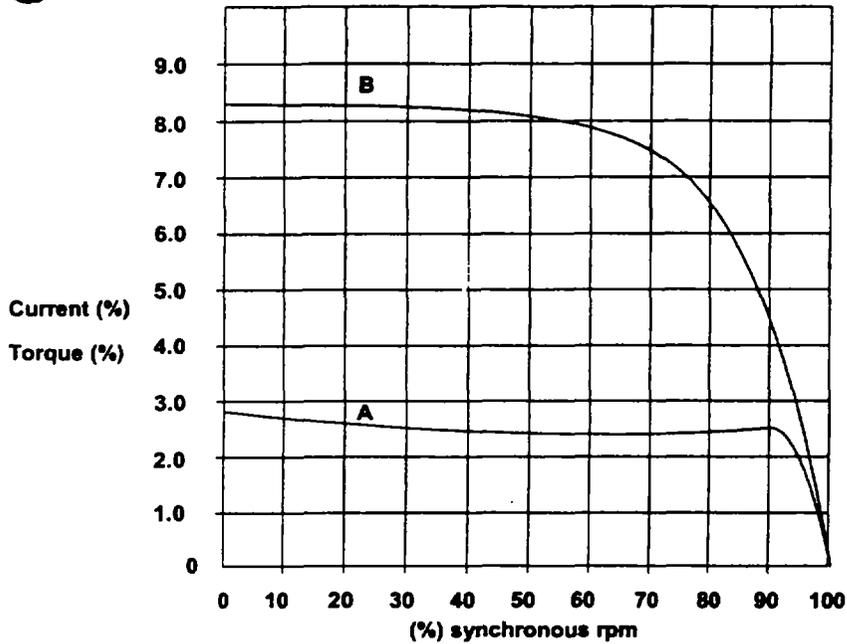


Nr.: Q12584R2

Date: 12 - Mar, 03

Customer : Montgomery Watson - ACS SBPA  
Motor line: EXPLOSION PROOF - UL

### TORQUE AND CURRENT CURVES

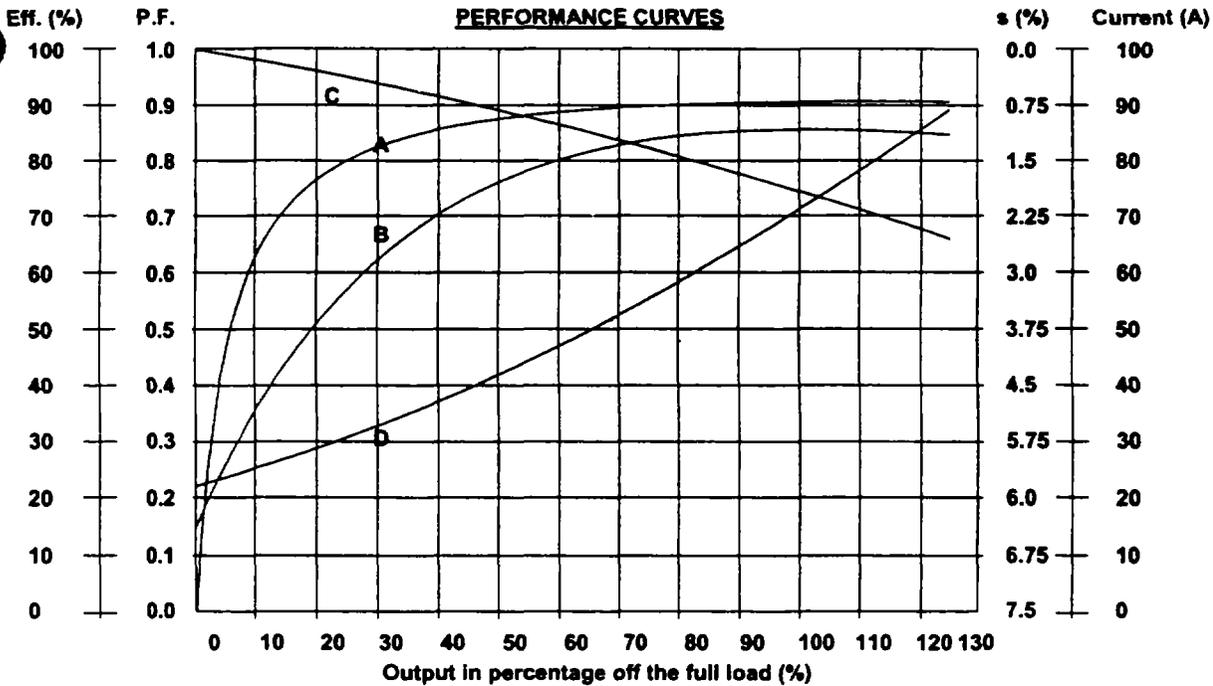


Output: 30.0 HP (cv)  
Poles: 4 Poles  
Frequency: 60 Hz  
LRT (%): 2.8  
BDT (%): 2.5  
Ip (%): 8.3  
Voltage: 230 Volts

B - Current curve

A - Torque curve

### PERFORMANCE CURVES



A - Efficiency  
B - Power Factor

C - Slip  
D - Current

performed :  
Karen Mayes

Checked :

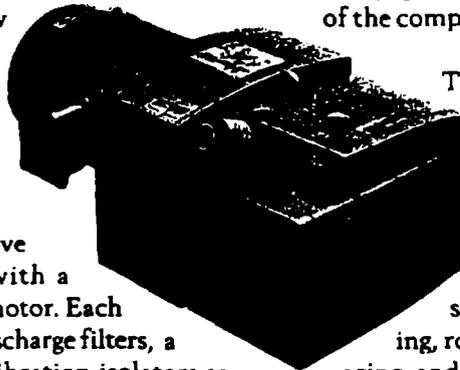
\* Note: The values shown are subject to change without prior notice

# KDT3.60 — 3.140 Series

## 100% OIL-LESS COMPRESSORS

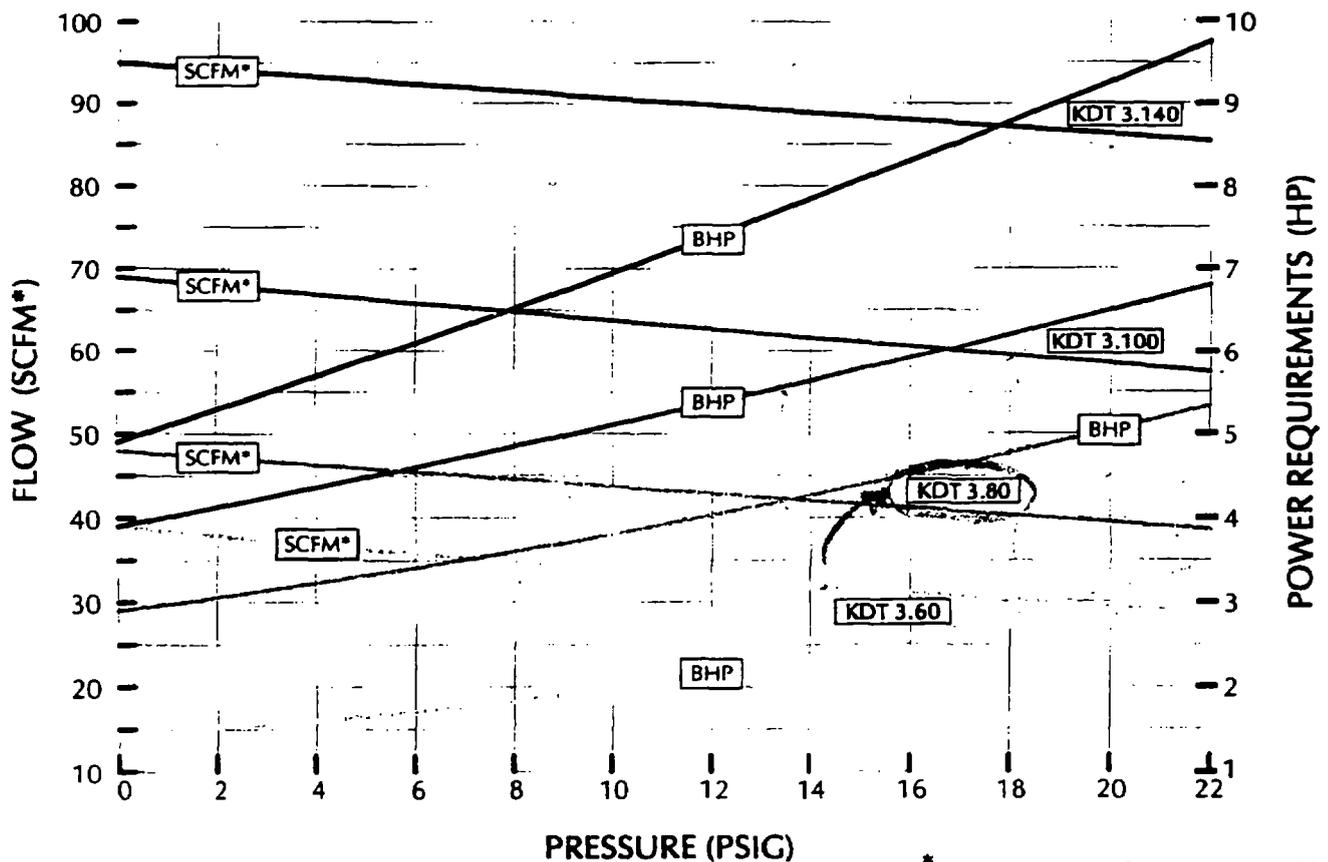
The Becker KDT series is a line of 100% Oil-less, rotary vane, low pressure compressors. They are designed to operate on a continuous basis throughout a pressure range from atmospheric pressure to 22 PSIG.

Each KDT unit is a direct drive compressor and is supplied with a TEFC flange mounted electric motor. Each unit is equipped with inlet and discharge filters, a pressure regulating valve, and vibration isolators as



standard equipment, all of which are an integral part of the compressor.

The Becker KDT compressor is ideal for applications where air is the gas and where operation is in the low pressure range where high pressure compressors are less efficient. Applications for the KDT compressor include graphic arts, soil remediation, pneumatic conveying, robotics and material handling, packaging, and paper converting.



\* @ 29.92" Hg Bar. Pr.; 68°F; 36% R.H.; 0.075#/ft<sup>3</sup>

PRINT Close



**Eclipse®  
Model 708  
Guided Wave Radar  
Transmitter**

MODEL. No. 708-511A-310

The Eclipse Model 708 is a loop-powered, 24 VDC, liquid level transmitter based upon the revolutionary Guided Wave Radar (GWR) Technology. The Model 708 is designed for use with Single Rod Probe Models 7XF and 7X1. These leading-edge transmitters are designed to provide measurement performance well beyond that of many traditional technologies; as well as, "through-air" radars.

Printed from [www.magnetrol.com](http://www.magnetrol.com)  
on Wednesday, November 19, 2003

### Measurement Principle:

Guided Wave Radar is based upon the principle of TDR (Time Domain Reflectometry). Pulses of electromagnetic energy are transmitted down a probe. The pulse is reflected when it reaches a liquid surface.

### Features:

- Two-wire, 24 VDC, loop-powered level transmitter
- HART digital communications (optional)
- Unprecedented, innovative, ergonomic, dual compartment housing
- Quick connect/disconnect probe coupling
- Ignores coating build-up
- Operates in visible vapors and ignores most foams

### Applications:

- Liquids or slurries
- Dielectric 1.9 to 100
- Most process or storage vessels
- Bridles and by-pass chambers
- Twin flex to 50 feet (dielectric constant 2)

### Options:

- HART
- Display/keypad
- Local remote mounting

Page Last Updated: 10/13/2003  
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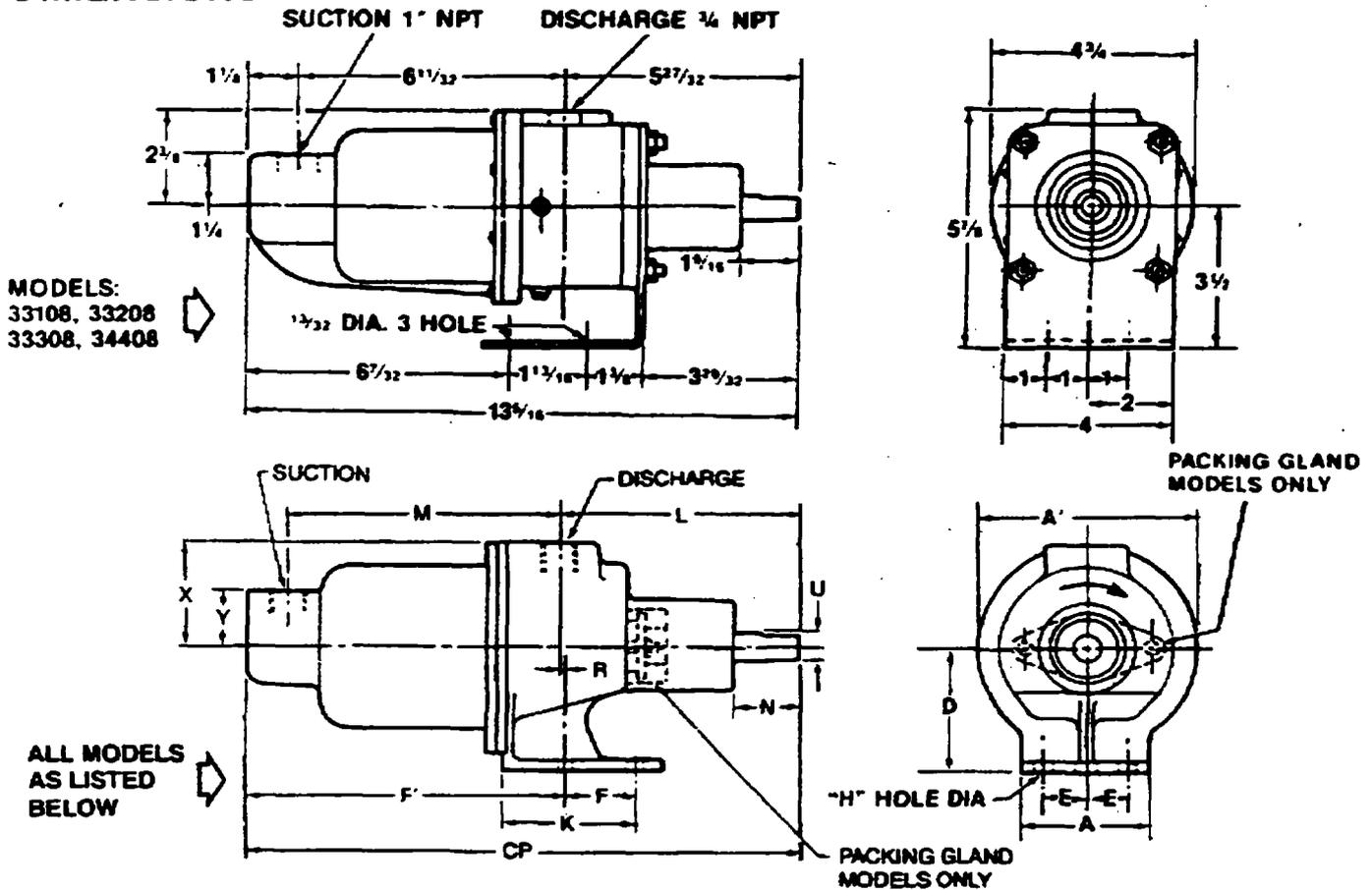
Always the Right Solution™

Section:  
**MOYNO® 500 PUMPS**  
 Page: 1 of 4  
 Date: March 30, 1996

SPECIFICATION DATA  
**MOYNO® 500 PUMPS**

300 SERIES  
 331, 332, 333, 344, 356 AND 367 MODELS

**DIMENSIONS**



MODELS:  
 33108, 33208  
 33308, 34408

ALL MODELS  
 AS LISTED  
 BELOW

MODELS	CP	A	A'	D	E	F	F'	H	K	L	M	N	R	U	X	Y	SUCT (NPT)	DISCH (NPT)
33101, 33201 33301, 33104 33204, 33304 34401, 34404	12 5/8	3 1/4	4 3/4	2 1/4	1	1 13/16	6 15/16	13 1/32	3 1/32	5 11/16	6 1/16	1 7/16	—	5/8	2 1/8	1 1/4	3/4	3/4
*34411	13 15/16	3 1/4	4 3/4	2 1/4	1 1/8	—	7 1/16	13 1/32	2 1/8	7	6 1/16	1 3/8	1/4	5/8	2 1/16	1 1/4	3/4	3/4
35601, 35604	17 1/2	6 1/2	7 1/16	4 9/32	1 1/4	2	10 9/32	13 1/32	4 1/2	7 1/8	8 5/8	2 1/8	15/32	3/4	3 25/32	2 1/8	1 1/2	1 1/4
*35611, *35613	19 7/8	6 1/2	7 1/16	4 9/32	1 1/4	2 1/2	10 9/32	13 1/32	4 1/2	9 11/32	8 5/8	2 1/8	9/16	3/4	3 25/32	2 1/8	1 1/2	1 1/4
36701, 36704	20 15/16	5 1/4	B	4 1/2	2	2 5/16	13	9/16	4 1/16	7 15/16	11 3/16	2 1/8	—	1	4	2 1/2	2	2

\*Packing Gland Model

All dimensions are in inches. Specifications subject to change without notice.

# SWING CHECK VALVES



## Features – PVC, CPVC, PP

Designed for optimum flow, quick response and positive shutoff with minimum turbulence, this industrial grade Swing Check Valve is used in a variety of industrial and chemical processing applications where high volume fluid transfer is required. Suitable for horizontal or up-flow vertical applications. Available in PVC, CPVC and Glass Filled Polypropylene, IPS 3/4" - 8" with Flanged Body.

- Engineered for Quick Response, Full-Flow Fluid Transfer
- Heavy Dotted All-Plastic Interior Construction
- Top Access & O-ring Sealed Drain Plug for In-line Servicing
- Standard O-ring type Seat & Gaskets in EPDM or genuine Viton®
- Size 3/4" - 4" Pressure Rated to 150 psi @ 73°F, 6" Pressure Rated to 100 psi and 8" to 70 psi @ 73°F
- Stainless Steel External Hardware
- Fully Serviceable, Replaceable Components
- Suitable for Vacuum Service
- Assembled with Silicon-Free, Water Soluble Lubricants

## Sample Engineering Specification

All thermoplastic check valves shall be flanged Swing Check type constructed from PVC Type I, ASTM D 1784 Cell Classification 12454 or CPVC Type IV, ASTM D1784 Cell Classification 23447, or Polypropylene, ASTM D 4101. All O-rings shall be EPDM or genuine Viton®. All valves components shall be replaceable. All valve shall have top-entry access with O-ring sealed drain plug for in-line servicing. All valves shall have optional external Arrow Position Indicator or optional external Counter Balance. All 3/4" - 4" valves shall be pressure rated to 150 psi, all 6" valves to 100 psi, and all 8" valves to 70 psi for water at 73° F, as manufactured by Spears Manufacturing Company.

## Options & Accessories

- External Arrow Position Indicator
  - External Counter Balance
  - Natural Polypropylene Body
- † Available as assembled valve or kit for installed valve

## Quick-View Valve Selection Chart

Valve Size	O-ring Material	Part Number <sup>1,2,3</sup>	Pressure Rating	
3/4	EPDM	4423-007	150 psi Non-Spark Water @73°F	
	Viton®	4433-007		
1	EPDM	4433-010		
	Viton®	4433-010		
1-1/2	EPDM	4433-015		
	Viton®	4433-015		
2	EPDM	4423-020		
	Viton®	4433-020		
2-1/2	EPDM	4423-025		
	Viton®	4433-025		
3	EPDM	4433-030		
	Viton®	4433-030		
4	EPDM	4433-040		
	Viton®	4433-040		
6	EPDM	4423-050		100 psi @73°F
	Viton®	4433-050		
8	EPDM	4423-060	70 psi @73°F	
	Viton®	4433-060		

1: For CPVC valves, add the letter "C" to part numbers listed (e.g. 4423-007C).  
 2: For valves with Arrow Position Indicator, add the letter "A" before the dash separator (e.g. 4423-007A).  
 3: For Polypropylene valves, add the letter "P" to the part number (e.g. 4423-007P).

**General Installation Information:** Swing check valves are designed for horizontal installations, but may be installed in up-flow only vertical position. Check valves MUST be installed with the valves FLOW arrow pointing in the direction of flow. Do not install valve upside down. Normal flange-bolt assembly in top holes of the valve flange requires bolt insertion through the companion flange with nuts secured on Swing Check flange side. Certain system configurations involving direct connection of a Swing Check Valve to other flanged equipment may require consideration of this bolt clearance.

Post-It® Fax Note	7871	Date	4/12/04	Page	3
To	BUTCH	From			
Co./Dept.		Co.			
Phone #		Phone #			
Fax #	219-924-3978	Fax #			

# SWING CHECK VALVES



## Temperature Pressure Rating

Temperature T (°C)	34F - 4'		6'		8'	
	PVC	CPVC	PVC	CPVC	PVC	PP
400	(149)	(143)	(149)	(141)	(149)	(141)
450	(136)	(130)	(140)	(132)	(140)	(132)
500	(123)	(117)	(130)	(122)	(130)	(122)
550	(110)	(104)	(120)	(112)	(120)	(112)
600	(97)	(91)	(110)	(102)	(110)	(102)
650	(84)	(78)	(100)	(92)	(100)	(92)
700	(71)	(65)	(90)	(82)	(90)	(82)
750	(58)	(52)	(80)	(72)	(80)	(72)
800	(45)	(39)	(70)	(62)	(70)	(62)
850	(32)	(26)	(60)	(52)	(60)	(52)
900	(19)	(13)	(50)	(42)	(50)	(42)
950	(6)	(0)	(40)	(32)	(40)	(32)
1000	(-7)	(-13)	(30)	(24)	(30)	(24)
1100	(-20)	(-26)	(20)	(16)	(20)	(16)
1200	(-33)	(-39)	(10)	(8)	(10)	(8)
1300	(-46)	(-52)	(0)	(0)	(0)	(0)

## Arrow Position Indicator Kit

Spears Swing Check Valve Indicator Kit is designed for field installation of external Indicator Arrow in Spears Swing Check Valves. This kit can be installed through the bonnet assembly and removal of valve from line is not required.

### Kit Includes:

- 1 - Extended Shaft
- 2 - Shaft Cup Seals
- 1 - Shaft Nut
- 1 - Indicator Arrow
- 1 - Retaining clip

Valve Size (in.)	Part Numbers		
	PVC NR	CPVC NR	PP NR
3/4	1SK-007	1SK-007C	1SK-007P
1	1SK-010	1SK-010C	1SK-010P
1-1/2	1SK-015	1SK-015C	1SK-015P
2	1SK-020	1SK-020C	1SK-020P
2-1/2	1SK-025	1SK-025C	1SK-025P
3	1SK-030	1SK-030C	1SK-030P
4	1SK-040	1SK-040C	1SK-040P
6	1SK-060	1SK-060C	1SK-060P
8	1SK-080	1SK-080C	1SK-080P

## Application of Counter Balance

Swing Check Valves operate in response to a fluid stream flow opening a swinging disc. As the fluid stream slows and reverses, the disc responds by swinging to the closed position. Sudden reversal of flow direction can result in "hammering" conditions as the disc opens. The function of the Counter Balance mechanism is to start the disc closing earlier as the fluid stream begins to slow so that it is almost closed when flow reversal takes place, thereby eliminating damaging of the disc. Available as installed unit with valve or as a kit for adaptation of installed valves.

## Counter Balance Kits

Spears Swing Check Valve Counter Balance Kit is designed for field installation of counter balance mechanism in Spears Swing Check Valves. This kit can be installed through the bonnet assembly and removal of valve from line is not required.

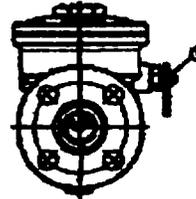
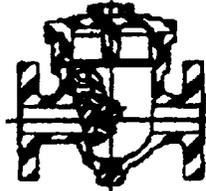
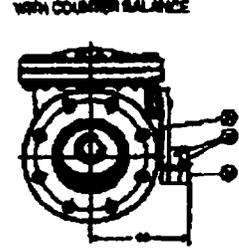
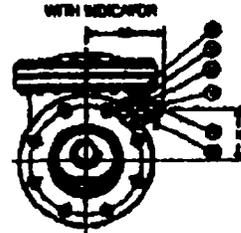
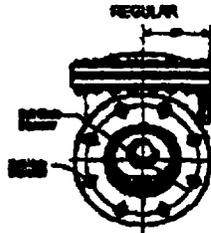
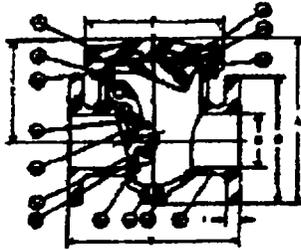
### Kit Includes:

- 1 - Extended Shaft
- 2 - Shaft Cup Seals
- 1 - Shaft Nut
- 1 - Counter Balance
- 1 - Retaining Bolt
- 1 - Flat Washer
- 1 - Extra Weight Plates (1-small & 1-large)
- 1 - Plate Mounting Bolts (2-long & 2-short)

Valve Size (in.)	Part Numbers			
	PVC NR	CPVC NR	PP NR	PP NR
3/4	CSBK-007	CSBK-007C	CSBK-007P	CSBK-007P
1	CSBK-010	CSBK-010C	CSBK-010P	CSBK-010P
1-1/2	CSBK-015	CSBK-015C	CSBK-015P	CSBK-015P
2	CSBK-020	CSBK-020C	CSBK-020P	CSBK-020P
2-1/2	CSBK-025	CSBK-025C	CSBK-025P	CSBK-025P
3	CSBK-030	CSBK-030C	CSBK-030P	CSBK-030P
4	CSBK-040	CSBK-040C	CSBK-040P	CSBK-040P
6	CSBK-060	CSBK-060C	CSBK-060P	CSBK-060P
8	CSBK-080	CSBK-080C	CSBK-080P	CSBK-080P



# SWING CHECK VALVES



## Replacement Parts

No.	Component	Qty.	Material
01	Body	1	PVC 1/CPVC/PP
02	Plug	1/21	PVC 1/CPVC/PP
03	Plug O-ring	1/21	EPDM/ITON <sup>®</sup>
04	Disc O-ring A	1	EPDM/ITON <sup>®</sup>
05	Disc	1	PVC 1/CPVC/PP
06	Disc Ret. Clip	1	PP
07	Disc O-ring B	1	EPDM/ITON <sup>®</sup>
08	Swing Arm	1	PVC 1/CPVC/PP
09	Nut	12-30	SS316
10	Washer	24-80	SS316
11	Bolt	12-30	SS316
12	Bonnet	1	PVC 1/CPVC/PP

No.	Component	Qty.	Material
13	Seal Carrier	1	PVC 1/CPVC/PP
14	Body O-ring	1	EPDM/ITON <sup>®</sup>
15	Arm Pin	1	PVC 1/CPVC/PP
16	Arm Pin Seal	2	VTON <sup>®</sup>
17	Arm Pin Plug	1	PVC 1/CPVC/PP
18	Arm Pin Washer	1	SS316
19	Arm Pin Bolt	1	SS316
20	Indicator	1	PP
21	Counterbalance	1	PVC 1
22	Weight Block	1	PVC 1
23	Weight Block Bolt	2	SS316
24	Arm Pin Ret. Clip	1	PP

1: Use 2 pcs. for regular non-indicator valve

## Dimensions

Nominal Size	A	B	C	D	E	F	G1	G2	G3	H	I	Approx. Wt (Lbs.)	
												PVC	CPVC
3/4	5-13/16	6-1/2	5-7/8	3/4	3-3/4	3-3/4	2-1/2	3	TBA	1-7/16	1/2	1.72	1.80
1	6-5/8	6-5/16	4-1/4	31/32	4-1/2	4-1/2	2-25/32	3-7/32	TBA	1-21/32	5/8	2.82	2.80
1-1/2	7-3/8	7-3/32	5	1-18/32	4-9/16	5-3/4	3-3/16	3-28/32	TBA	1-27/32	23/32	4.81	4.87
2	8-1/2	7-7/8	6	2	5-1/4	7	3-8/16	4-1/8	TBA	2-29/32	13/16	6.99	7.24
2-1/2	10-3/4	10-1/4	7-1/2	3-1/8	6-3/4	8-5/8	4-1/4	6	6-8/32	3-1/16	7/8	14.77	16.74
3	10-3/4	10-1/4	7-1/2	3-1/8	6-3/4	8-5/8	4-1/4	8	6-8/32	3-1/16	7/8	14.77	16.74
4	11-3/4	11-13/16	9	3-28/32	7-1/4	9-1/2	4-1/2	5-1/4	6-17/32	3-17/32	31/32	18.37	18.78
6	15-5/8	15-3/4	11	5-7/8	9-1/2	13-7/16	6	6-3/4	8-1/32	5-1/32	1	42.64	44.58
8	19-1/8	19-23/32	13-1/2	7-7/8	11-5/8	18-5/16	7	7-3/4	8-1/32	6-1/2	1-1/32	68.06	78.05

TBA: To Be Announced

## Cv Values

Valve Size	Cv <sup>1</sup>
3/4	18
1	24
1-1/2	70
2	86
2-1/2	300
3	300
4	480
6	1100
8	1800

<sup>1</sup>: Gallons per minute at 1 psi pressure drop.

Nominal Size	Bolt Circle Diameter	Bolt Hole Diameter	Number of Bolt Holes
3/4	2-3/4	5/8	4
1	3-1/8	5/8	4
1-1/2	3-7/8	5/8	4
2	4-3/4	3/4	4
2-1/2	5-1/2	3/4	4
3	6	3/4	4
4	7-1/2	3/4	8
6	9-1/2	7/8	8
8	11-3/4	7/8	8

**APPENDIX H**

**SYSTEM PIPING QUALITY CONTROL TEST RESULTS**

**System Piping Pressure Testing Results  
ACS NPL Site  
Griffith, Indiana**

Type	Pipe ID	Pipe Diameter (Inches)	Test Date	Initial Pressure (psi)	Final Pressure (psi)	Percent Change	Test Duration (min.)	Comment
Groundwater Extraction	19	2	9/26/2002	90	90	0.0%	15	
	7	2	9/26/2002	90	90	0.0%	15	
	3	3	9/26/2002	90	90	0.0%	15	
	13	8	10/2/2002	50	50	0.0%	30	
	1?	8	10/2/2002	50	50	0.0%	30	
	3	3	10/9/2002	91	91	0.0%	15	
	17	2	10/9/2002	90	89.5	0.6%	15	
	3	3	10/10/2002	90	90	0.0%	15	
	17	2	10/17/2002	90	89	1.1%	15	
	SVE-61, 63, 65	3	12/10/2002	50	36	28.0%	60	Fail
	SVE-61, 63, 65	3	12/10/2002	50	48	4.0%	30	Retest
	SVE-61, 63, 65	2	12/11/2002	100	98.5	1.5%	15	Retest
	SVE-87, 77	3	11/25/2002	20	20	0.0%	15	
	SVE-87, 77	3	11/25/2002	93	93	0.0%	15	
PERIMETER	3	12/11/2002	98	98	0.0%	15		
Air Sparge	AS-1	1	2/10/2003	100	100	0.0%	22	
	AS-2	1	2/10/2003	98	98	0.0%	15	
	AS-3	1	2/10/2003	97	97	0.0%	18	
	AS-4	1	2/10/2003	97	97	0.0%	15	
	AS-5	1	2/10/2003	95	95	0.0%	15	
	AS-6	1	2/10/2003	95	94	1.1%	15	
Compressed Air	Air Line #1	1	2/7/2003	153	153	0.0%	15	
	Air Line #2	1	2/7/2003	154	140	9.1%	15	Fail
	Air Line #2	1	2/7/2003	152	152	0.0%	15	Retest
	Air Line #3	1	2/7/2003	154	154	0.0%	15	
	Air Line #4	1	2/7/2003	156	156	0.0%	15	
Vapor Extraction	Air Line #5	1	2/7/2003	155	155	0.0%	15	
	SVE-43	3	1/10/2003	95	95	0.0%	15	
	SVE-44	3	1/10/2003	97	95	2.1%	60	
	SVE-45	3	1/10/2003	95	84	11.6%	60	Fail
	SVE-45	3	1/10/2003	95	94	1.1%	15	Retest
	SVE-46	3	1/10/2003	95	88	7.4%	15	Fail
	SVE-46	3	1/10/2003	95	90	5.3%	15	Fail
	SVE-46	3	1/10/2003	95	91	4.2%	15	Fail
	SVE-46	3	1/13/2003	95	94	1.1%	15	Retest
	SVE-47	3	1/10/2003	95	95	0.0%	15	
	SVE-48	3	1/10/2003	95	94	1.1%	15	
	SVE-49	3	1/10/2003	95	94	1.1%	15	
	SVE-50	3	1/10/2003	96	94	2.1%	15	
	SVE-51	3	1/10/2003	95	94	1.1%	15	
	SVE-52	3	1/10/2003	95	92	3.2%	15	
	SVE-52	3	1/10/2003	95	93	2.1%	15	
	SVE-53	3	1/10/2003	94	93	1.1%	15	
	SVE-54	3	1/10/2003	95	95	0.0%	15	
	SVE-55	3	1/10/2003	95	94	1.1%	15	
	SVE-56	3	1/10/2003	94	94	0.0%	15	
SVE-57	3	1/10/2003	95	94	1.1%	15		
SVE-58	3	1/10/2003	95	94	1.1%	15		
SVE-59	3	1/10/2003	95	93	2.1%	15		
SVE-60	3	1/13/2003	95	95	0.0%	15		

Compressive Strength Test Results  
 For Concrete Protective Cover  
 System Piping Installation  
 SBPA ISVE System

CAD  
 4/14/04

	<b>Great Lakes Soil &amp; Environmental Consultants, Inc.</b> 333 Shore Drive, Burr Ridge, IL 60521 Ph: (630) 321-0944 Fax: (630) 321-0945	<b>CONCRETE CYLINDER          COMPRESSIVE STRENGTH TEST REPORT          ASTM C39-94</b>
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<b>Project</b>	ACS Superfund Site, Griffith, IN						
<b>Client</b>	Montgomery Watson Constructors, Inc. 2775 Diehl Road, Suite 300, Warrenville, IL 60555						
<b>File No.</b>	2147	<b>Set No.</b>	3	<b>Report Print Date</b>	10/11/03	<b>Qc By</b>	VJS

<b>Specifications</b>				
<b>Mix Design #</b>	1060-2	6BG		
<b>Strength Spec.</b>	4000	psi at	28	Days
<b>Slump Range From</b>	2.00	to	5.00	inches
<b>Air Content Range From</b>	5.0	to	8.0	%

<b>Supplier &amp; Sub Information</b>	
<b>Concrete Subcontractor</b>	
<b>Concrete Supplier</b>	Ozinga

<b>Field Test Data</b>					
<b>Field Test Date:</b>	3/21/03	<b>Time Tested:</b>	1:25 PM	<b>Field Testing By:</b>	AK
<b>Location of Use:</b>	Trench				
<b>Truck No.</b>	905	<b>Ambient Temperature</b>	40	°F	
<b>Ticket No.</b>	143207	<b>Concrete Temperature</b>	66	°F	
<b>Load Size, cu. Yd.</b>	8.50	<b>Final Slump</b>	4.00	in.	Pass
		<b>Final Air Content</b>	5.0	%	Pass

<b>Laboratory Test Data</b>						
<b>Date Received:</b>	3/24/03				<b>No. of Specimens:</b>	4
<b>Lab Number</b>	22554	22555	22556	22557		
<b>Specimen Diameter, in</b>	6.00	6.00	6.00	6.00		
<b>Specimen Area, in<sup>2</sup></b>	28.29	28.29	28.29	28.29		
<b>Specimen Age</b>	7	14	28	28		
<b>Test Date</b>	3/28/03	4/4/03	4/18/03	4/18/03		
<b>Tested By</b>	LN	WL	WL	WL		
<b>Maximum Load, lb</b>	128560	147470	150730	151750		
<b>Actual Strength, psi</b>	4540	5210	5330	5360		
<b>Type of Failure</b>	Shear	Shear	Shear	Shear		
<b>Test Result</b>	Pass	Pass	Pass	Pass		

<b>Miscellaneous Information</b>	
<b>Equipment Serial #</b>	FORNEY 02108

<b>Remarks</b>

Compressive Strength Test Results  
 For Concrete Protective Cover  
 System Piping Installation  
 SBPA ISVE System

CAD  
 4/14/04



**Great Lakes Soil & Environmental Consultants, Inc.**

333 Shore Drive, Burr Ridge, IL 60521 Ph: (630) 321-0944 Fax: (630) 321-0945

**CONCRETE CYLINDER  
 COMPRESSIVE STRENGTH TEST REPORT  
 ASTM C39-84**

<b>Project</b>	ACS Superfund Site, Griffith, IN						
<b>Client</b>	Montgomery Watson Constructors, Inc. 2775 Diehl Road, Suite 300, Warrenville, IL 60555						
<b>File No.</b>	2147	<b>Set No.</b>	4	<b>Report Print Date</b>	10/11/03	<b>Qc By</b>	VJS

**Specifications**

<b>Mix Design #</b>	1060-2 6BG			
<b>Strength Spec.</b>	4000	<b>psi at</b>	28	<b>Days</b>
<b>Slump Range From</b>	2.00	<b>to</b>	5.00	<b>inches</b>
<b>Air Content Range From</b>	5.0	<b>to</b>	8.0	<b>%</b>

**Supplier & Sub Information**

<b>Concrete Subcontractor</b>	
<b>Concrete Supplier</b>	Ozinga

**Field Test Data**

<b>Field Test Date:</b>	3/24/03	<b>Time Tested:</b>	1:30 PM	<b>Field Testing By:</b>	AK
<b>Location of Use:</b>	Trench/pipe encasment				
<b>Truck No.</b>	905	<b>Ambient Temperature</b>	65	<b>°F</b>	
<b>Ticket No.</b>	143273	<b>Concrete Temperature</b>	70	<b>°F</b>	
<b>Load Size, cu. Yd.</b>	8.00	<b>Final Slump</b>	5.00	<b>in.</b>	Pass
		<b>Final Air Content</b>	6.0	<b>%</b>	Pass

**Laboratory Test Data**

<b>Date Received:</b>	3/25/03				<b>No. of Specimens:</b>	4		
<b>Lab Number</b>	22630	22631	22632	22633				
<b>Specimen Diameter, in</b>	6.00	6.00	6.00	6.00				
<b>Specimen Area, in<sup>2</sup></b>	28.29	28.29	28.29	28.29				
<b>Specimen Age</b>	7	14	28	28				
<b>Test Date</b>	3/31/03	4/7/03	4/21/03	4/21/03				
<b>Tested By</b>	WL	WL	WL	WL				
<b>Maximum Load, lb</b>	131430	150550	169400	163060				
<b>Actual Strength, psi</b>	4650	5320	5990	5760				
<b>Type of Failure</b>	Shear	Shear	Shear	Shear				
<b>Test Result</b>	Pass	Pass	Pass	Pass				

**Miscellaneous Information**

<b>Equipment Serial #</b>	FORNEY 02108
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**Remarks**

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Proctor Test Results  
 For Clay Cover (performed during cover construction)  
 System Piping Installation  
 SBPA ISVE System

11/1/02



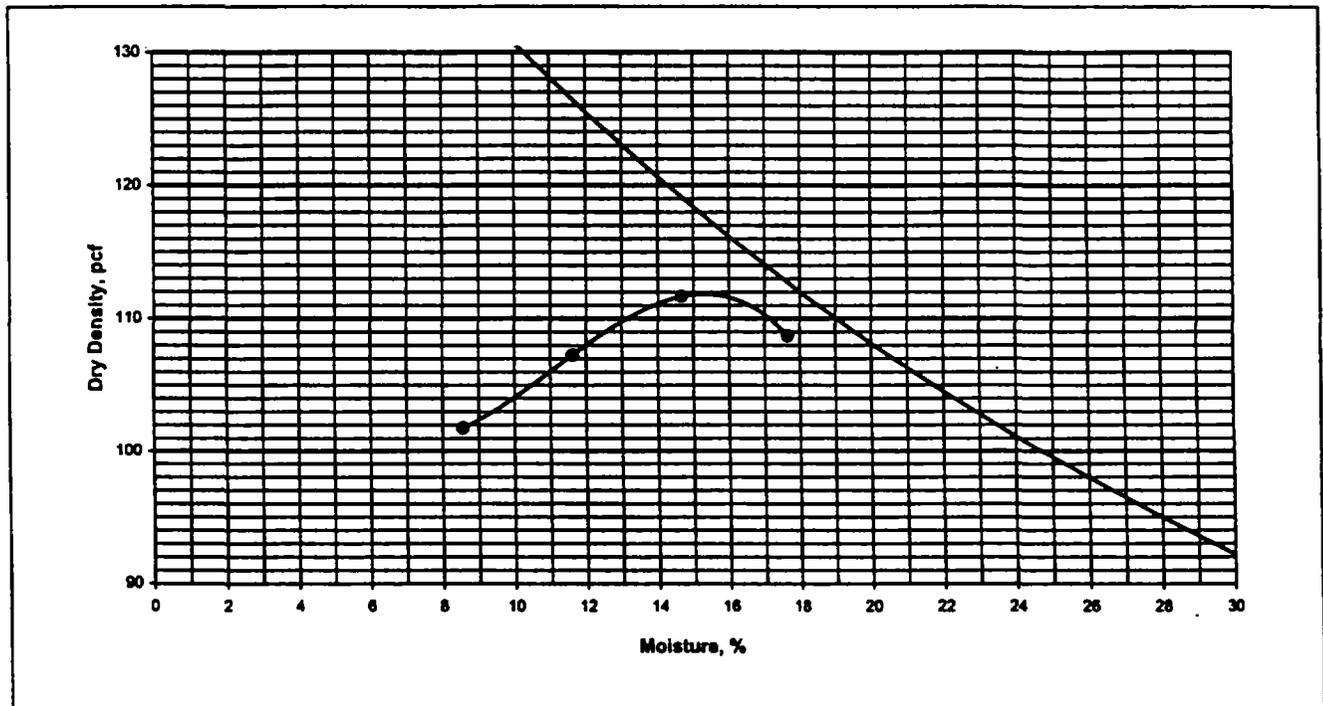
**Great Lakes Soil & Environmental Consultants Inc.**  
 333 Shore Drive, Burr Ridge, IL 60521 Ph: (630) 321-0944 Fax: (630) 321-0945

**MOISTURE - DENSITY  
 RELATIONSHIP CURVE**

**ASTM D698-91**

<b>Project</b>	ACS-SBPA						
<b>Client</b>	Hard Hat Services, Inc. 1701 Quincy Ave, Suite 29, Naperville, IL 60540 Attn.: Mr. John McDonough						
<b>File No.</b>	2490	<b>Sample #</b>	BS-1	<b>Date Tested</b>	9/4/2002	<b>Tested By</b>	MC
						<b>Qc By</b>	NP

<b>Date Sample Recd.</b>	9/3/02								
<b>Sample Location</b>	Stockpile								
<b>Sample Description</b>	Light Brown Silty Clay								
<b>Type of Proctor</b>	Standard	<b>Method:</b>	A	<b>Mold Size, in.</b>	4	<b>Hammer Weight, lb.</b>	5.5	<b>Drop, in.</b>	12
<b>No. of Layers</b>	3	<b>No. of Blows per Layer</b>		25					



Zero Air Void Curve Specific Gravity: 2.65

<b>Results</b>	<b>Maximum Dry Density, pcf</b>	112.0	<b>Optimum Moisture Content, %</b>	15.0	<b>Natural Moisture Content, %</b>	6.6
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**Remarks**







**APPENDIX I**

**SYSTEM PIPING MATERIAL SPECIFICATIONS**



## PERFORMANCE PIPE

A DIVISION OF CHEVRON PHILLIPS CHEMICAL COMPANY LP

2929 NORTH CENTRAL EXPRESSWAY, SUITE 300  
P.O. BOX 83-3866  
RICHARDSON, TEXAS 75083-3866 • 972/783-2666

March 25, 2002

Forrer Supply Co., Inc.  
W194 N11811 McCormick Drive  
Germantown, WI 53022  
(262) 255-3030

RE: DriscoPlex 4100 Series

This letter is being written at your request concerning DriscoPlex 4100 series pipe. DriscoPlex 4100 series pipe is manufactured from resin that has a cell class of PE 345464C according to ASTM D3350. This is a high density, high molecular weight polyethylene resin that meets the criteria for a Type III piping material in accordance with ASTM D3350. The resin has a Plastic Pipe Institute recommended hydrostatic basis of 1800 psi at 23°C and 800 psi at 60°C based on TR/3 as derived from ASTM D-2837 test methodology.

The dimensional characteristics and pressure capabilities of DriscoPlex 4100 are established in accordance with the guidelines set forth in ASTM F714 for pipe sizes 3-inch and larger. Along with ASTM standards, DriscoPlex 4100 series meets the requirements of NSF 61 for potable water systems and AWWA C906 requirements for water piping systems. These standards are referenced in the print line, and repeated every two feet along the entire length of pipe.

Regards,

A handwritten signature in black ink, appearing to read "Heath W. Casteel".

Heath W. Casteel  
Technical Services Engineer



PERFORMANCE PIPE™

www.performancepipe.com

# DRISCOPLEX™ PE 3408 HDPE Data Sheet

Typical Material Physical Properties of DRISCOPLEX™ HDPE  
High Density Polyethylene Material

Property	Unit	Test Procedure	Typical Value
Material Designation	---	PPI-TR4	PE 3408
Cell Classification	---	ASTM D-3350	345464C
Density [3]	g/cm <sup>3</sup>	ASTM D-1505	0.955 (Black compounded material)
Melt Index [4]	g/10 minutes	ASTM D-1238	0.1
Flexural Modulus [5]	psi	ASTM D-790	>130,000
Tensile Strength [4]	psi	ASTM D-638	3200
SCG (PENT) [6]	Hours	ASTM F 1473	>100
HDB@73.4°F (23°C) [4]	psi	ASTM D-2837	1600
Color; UV Stabilizer [C]	---	---	Black with minimum 2% carbon black
Linear Thermal Expansion	Inch/inch/°F	ASTM D-696	9 x 10 <sup>-5</sup>
Elastic Modulus	psi	ASTM D-638	710,000
Brittleness Temperature	°F (°C)	ASTM D-746	<180 (<-118)
Hardness	Shore D	ASTM D-2240	65

**NOTICE:** This data sheet provides typical physical property information for polyethylene resins used to manufacture PERFORMANCE PIPE™ polyethylene piping products. It is intended for comparing polyethylene piping resins. It is not a product specification, and it does not establish minimum or maximum values or manufacturing tolerances for resins or for piping products. These typical physical property values were determined using compression-molded plaques prepared from resin. Values obtained from tests of specimens taken from piping products can vary from these typical values. Performance Pipe has made every reasonable effort to ensure the accuracy of this data sheet, but this data sheet may not provide all necessary information, particularly with respect to special or unusual applications. This data sheet may be changed from time to time without notice. Contact Performance Pipe to determine if you have the most recent edition.



## Model Specification 507

# DRISCOPEX™ 4000 and DRISCOPEX™ 4100 Piping for Potable Water Distribution and Transmission

*The user may choose to adopt part or all of this Model Specification; however, the user should ensure that all parts used are appropriate for the user's purpose. See notice below.*

### 1 General Terms and Conditions

- 1.1 Scope. This specification covers requirements for DRISCOPEX™ 4000 and DRISCOPEX™ 4100 PE 3408 high-density polyethylene piping for potable water distribution and transmission mains. All work shall be performed in accordance with these specifications.
- 1.2 Engineered and Approved Plans. Potable water distribution and transmission main construction shall be performed in accordance with engineered construction plans for the work prepared under the direction of a Professional Engineer.
- 1.3 Referenced Standards. Where all or part of a Federal, ASTM, ANSI, AWWA, etc., standard specification is incorporated by reference in these Specifications, the reference standard shall be the latest edition and revision.
- 1.4 Licenses and Permits. A licensed and bonded Contractor shall perform all potable water distribution and transmission main construction work. The Contractor shall secure all necessary permits before commencing construction.
- 1.5 Inspections. All work shall be inspected by an Authorized Representative of the Owner who shall have the authority to halt construction if, in his opinion, these specifications or standard construction practices are not being followed. Whenever any portion of these specifications is violated, the Project Engineer or his Authorized Representative, shall, by written notice, order further construction to cease until all deficiencies are corrected. A copy of the order shall be filed with the Contractor's license application for future review. If the deficiencies are not corrected, performance shall be required of the Contractor's surety.

### 2 Polyethylene Pipe and Fittings

- 2.1 Qualification of Manufacturers. The Manufacturer shall have manufacturing and quality assurance facilities capable of producing and assuring the quality of the pipe and fittings required by these Specifications. The Manufacturer's production facilities shall be open for inspection by the Owner or his Authorized Representative. The Project Engineer shall approve qualified Manufacturers.
- 2.2 Approved Manufacturers. Manufacturers that are qualified and approved by the Project Engineer are listed below. Products from unapproved manufacturers are prohibited.

Performance Pipe a division of Chevron Phillips Chemical Company LP

- 2.3 Materials. Black PE materials used for the manufacture of polyethylene pipe and fittings shall be PE 3408 high density polyethylene meeting ASTM D 3350 cell classification 345464C and

**NOTICE.** This publication is intended for use as a guide to support the designer of piping systems, but it should not be used in place of the advice of a professional engineer. Performance Pipe has made every reasonable effort to ensure the accuracy of this publication, but it may not provide all necessary information, particularly with respect to special or unusual applications. This publication may be changed from time to time without notice. Contact Performance Pipe to determine if you have the most current edition.

shall be Listed in the name of the pipe and fitting Manufacturer in PPI (Plastics Pipe Institute) TR-4 with a standard grade HDB rating of 1600 psi at 73°F. Color material, when used, shall be the same except for meeting ASTM D 3350 cell classification 345464E. The material shall be listed and approved for potable water in accordance with NSF Standard 61. When requested on the order, the Manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements.

- 2.4 **Interchangeability of Pipe and Fittings.** The same Qualified and Approved Manufacturer shall produce polyethylene pipe and fittings. Products such as fittings or flange adapters made by sub-contractors or distributors are prohibited.
- 2.5 **Polyethylene Pipe.** Polyethylene pipe shall be manufactured in accordance with AWWA C901-96 for sizes 1-1/4" thru 3" IPS diameters and to the requirements of ASTM D3035. IPS and DIPS sizes 4" and above shall be manufactured to the requirements of ASTM F714 and AWWA C906-98 (IPS).
- 2.6 **Optional Service Identification Stripes for IPS sized Pipe.** IPS pipes shall be black. When requested as an option, IPS pipes shall have four, equally spaced, blue color stripes co-extruded into the pipe outside surface. Stripes printed on the pipe outside surface shall not be acceptable.
- 2.7 **Service Identification Stripes for DIPS Sized Pipe.** DIPS sized pipes shall have three equally spaced pairs of longitudinal blue color stripes co-extruded into the pipe outside surface. Stripes printed on the outside surface shall not be acceptable.
- 2.8 **Optional Color Shell.** When requested as an option, a blue color shell co-extruded into the pipe outer surface shall permanently identify IPS or DIPS pipes.
- 2.9 **Polyethylene Fittings & Custom Fabrications.** Polyethylene fittings and custom fabrications shall be molded or fabricated by the Approved Pipe Manufacturer. All fittings and custom fabrications shall be pressure rated for the same internal pressure rating as the mating pipe.
- 2.10 **Molded Fittings.** Molded fittings shall be manufactured and tested in accordance with ASTM D 3261 and shall be so marked. Molded fittings shall be tested in accordance with AWWA C906.
- 2.10.1 **X-Ray Inspection.** The Manufacturer shall submit samples from each molded fittings production lot to x-ray inspection.
- 2.11 **Fabricated Fittings.** Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock or molded fittings. Fabricated fittings shall be rated for internal pressure service at least equal to the full service pressure rating of the mating pipe. Fabricated fittings shall be tested in accordance with AWWA C906.
- 2.12 **Polyethylene Flange Adapters.** Flange adapters shall be made with sufficient through-bore length to be clamped in a butt fusion-joining machine without the use of a stub-end holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves (serrations) to promote gasketless sealing, or restrain the gasket against blowout.
- 2.13 **Back-up Rings & Flange Bolts.** Flange adapters shall be fitted with back-up rings that are pressure rated equal to or greater than the mating pipe. The back-up ring bore shall be chamfered or radiused to provide clearance to the flange adapter radius. Flange bolts and nuts shall be Grade 3 or higher.
- 2.14 **MJ Adapters.** MJ Adapters 4" thru 16" may be provided with optional Stainless Steel Stiffener

upon request. MJ Adapters 14" and above shall be provided with Heavy Duty Back-up Ring Kits. All MJ adapters 18" and above must be provided with Stainless Steel stiffeners.

- 2.15 **Compliance Tests.** Manufacturer's inspection and testing of the materials. In case of conflict with Manufacturer's certifications, the Contractor, Project Engineer, or Owner may request retesting by the Manufacturer or have retests performed by an outside testing service. All retesting shall be at the requestor's expense, and shall be performed in accordance with these Specifications.

### 3 **Joining**

- 3.1 **Heat Fusion Joining.** Joints between plain end pipes and fittings shall be made by butt fusion. Joints between the main and saddle branch fittings shall be made using saddle fusion. The butt fusion and saddle fusion procedures used shall be procedures that are recommended by the pipe and fitting Manufacturer. The Contractor shall ensure that persons making heat fusion joints have received training in the Manufacturer's recommended procedure. The Contractor shall maintain records of trained personnel, and shall certify that training was received not more than 12 months before commencing construction. External and internal beads shall not be removed.

- 3.1.1 **Butt Fusion of Unlike Wall Thickness.** Butt fusion shall be performed between pipe ends, or pipe ends and fitting outlets that have the same outside diameter and are not different in wall thickness by more than one Standard DR, for example, SDR 13.5 to SDR 17, or SDR 11 to SDR 13.5. Transitions between unlike wall thickness greater than one SDR shall be made with a transition nipple (a short length of the heavier wall pipe with one end machined to the lighter wall) or by mechanical means or electrofusion. Standard DR's for polyethylene pipe are 9, 11, 13.5, 17, 21, 26, 32.5 and 41.

- 3.1.2 **Heat Fusion Training Assistance.** Upon request and at the requestor's expense, training personnel from the Manufacturer or his Representative shall be made available.

- 3.2 **Joining by Other Means.** Polyethylene pipe and fittings may be joined together or to other materials by means of (a) flanged connections (flange adapters and back-up rings), (b) mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material, (c) MJ Adapters or (d) electrofusion. When joining by other means, the installation instructions of the joining device manufacturer shall be observed.

- 3.2.1 **ID Stiffener and Restraint.** A stiffener shall be installed in the bore of the polyethylene pipe when an OD compression mechanical coupling is used and when connecting plain end PE pipe to a mechanical joint pipe, fitting or appurtenance. External clamp and tie rod restraint shall be installed where PE pipe is connected to the socket of a mechanical joint pipe, fitting or appurtenance except where an MJ Adapter is used.

- 3.3 **Branch Connections.** Branch connections to the main shall be made with saddle fittings or tees. Polyethylene saddle fittings shall be saddle fused to the main pipe per 3.1.

### 4 **Installation**

- 4.1 **General.** When delivered, a receiving inspection shall be performed and any shipping damage shall be reported to the manufacturer within 7 days. Installation shall be in accordance with ASTM D 2774, Manufacturer's recommendations and this specification. All necessary precautions shall be taken to ensure a safe working environment in accordance with all applicable safety codes and standards.

- 4.2 **Excavation.** Trench excavations shall conform to the plans and drawings, as authorized in writing by the Project Engineer or his Approved Representative and in accordance with all applicable codes. The Contractor shall remove excess groundwater. Where necessary, trench walls shall be shored or reinforced, and all necessary precautions shall be taken to ensure a safe working environment.
- 4.3 **Large Diameter Fabricated Fittings.** Not more than one plain-end connection of 16" IPS and larger fabricated directional fittings (elbows, tees, etc.) shall be butt fused to the end of a pipe length before placing the assembly into the trench. The remaining fitting connections shall be made in the trench using butt fusion, flange or other connection means in accordance with 3.2. Flange and other mechanical connections shall be assembled, and tightened in accordance with the connection manufacturer's instructions and 4.4. Handling, lifting, moving or lowering a 16" IPS or larger fabricated fitting that is connected to more than one pipe length is prohibited. The installing contractor at his expense shall correct fitting damage caused by such improper handling.
- 4.4 **Mechanical Joint & Flange Installation.** Mechanical joint and flange connections shall be installed in accordance with the Manufacturer's recommended procedure. MJ Adapters and flanges shall be centered and aligned to the mating component before assembling and tightening bolts. In no case shall MJ gland or flange bolts be used to draw the connection into alignment. Bolt threads shall be lubricated, and flat washers should be used under the nuts. Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the Manufacturer. At least 1 hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the Manufacturer. The final tightening torque shall be as recommended by the Manufacturer.
- 4.5 **Foundation & Bedding.** Pipe shall be laid on grade and on a stable foundation. Unstable trench bottom soils shall be removed, and a 6" foundation or bedding of compacted Class I material shall be installed to pipe bottom grade. Excess groundwater shall be removed from the trench before laying the foundation or bedding for the pipe. A trench cut in rock or stony soil shall be excavated to 6" below pipe bottom grade, and brought back to grade with compacted Class I bedding. All ledge rock, boulders and large stones shall be removed.
- 4.6 **Pipe Handling.** When lifting with slings, only wide fabric choker slings capable of safely carrying the load shall be used to lift, move, or lower pipe and fittings. Wire rope and chain are prohibited. Slings shall be of sufficient capacity for the load, and shall be inspected before use. Worn or damaged equipment shall not be used.
- 4.7 **Backfilling.** Embedment material soil type and particle size shall be in accordance with ASTM D 2774. Embedment shall be placed and compacted to at least 90% Standard Proctor Density in 6" lifts to at least 6" above the pipe crown. During embedment placement and compaction, care shall be taken to ensure that the haunch areas below the pipe springline are completely filled and free of voids.
- 4.8 **Protection against shear and bending loads.** In accordance with ASTM D 2774, connections shall be protected where an underground polyethylene branch or service pipe is joined to a branch fitting such as a service saddle, branch saddle or tapping tee on a main pipe, and where pipes enter or exit casings or walls. The area surrounding the connection shall be embedded in properly placed, compacted backfill, preferably in combination with a protective sleeve or other mechanical structural support to protect the polyethylene pipe against shear and bending loads.
- 4.9 **Final Backfilling.** Final backfill shall be placed and compacted to finished grade. Native soils

may be used provided the soil is free of debris, stones, boulders, clumps, frozen clods or the like larger than 8" in their largest dimension.

5 Testing.

5.1 Fusion Quality. The Contractor shall ensure the field set-up and operation of the fusion equipment, and the fusion procedure used by the Contractor's fusion operator while on site. Upon request by the Owner, the Contractor shall verify field fusion quality by making and testing a trial fusion. The trial fusion shall be allowed to cool completely; then test straps shall be cut out and bent strap tested in accordance with ASTM D 2657. If the bent strap test of the trial fusion fails at the joint, the field fusions represented by the trial fusion shall be rejected. The Contractor at his expense shall make all necessary corrections to equipment, set-up, operation and fusion procedure, and shall re-make the rejected fusions.

5.2 Leak Testing. Hydrostatic leak testing shall be conducted in accordance with Performance Pipe Technical Note 802 *Leak Testing*. Pneumatic pressure testing is prohibited.



M/I SPEC 001

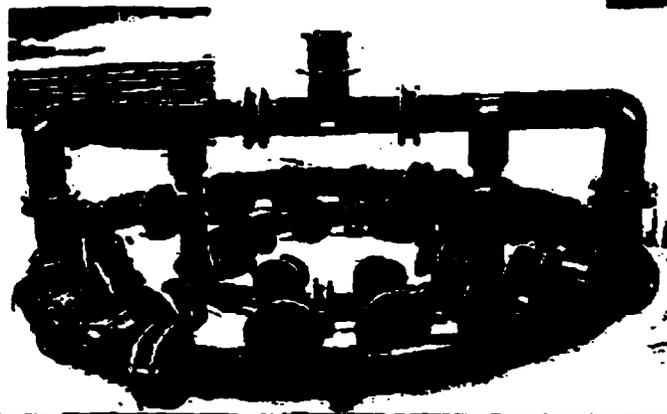
# MOLDED PE3408 FITTINGS

## Solves the Problem of Difficult Connections

### Features

- Engineered For Use On HDPE Pipe
- Available Size Range 1/2" CTS - 12" IRS
- Pressure Rated Up To 200 psi
- No De-rating Of Fitting Required
- PE3408 Resin Complies With ASTM D3350
- NSF Listed Resin
- Complies With ASTM D3261
- Meets AWWA C906
- FM Approved
- Can Be Heat Fused or Electrofused
- Can Be Used With All Conventional Fusion Equipment

Made in U.S.A.



Central Plastics Company  
 1901 W. Independence St.  
 Shawnee, OK USA 74801

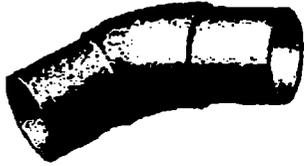
[www.centralplastics.com](http://www.centralplastics.com)

Phone: 800-654-3872  
 405-273-6302  
 Fax: 800-733-5993  
 405-273-5993

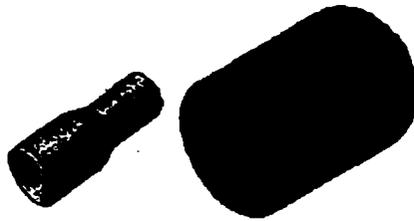
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**MOLDED FITTINGS**

M/I SPEC 001



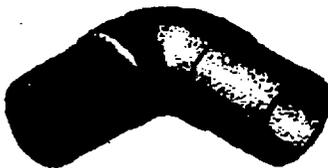
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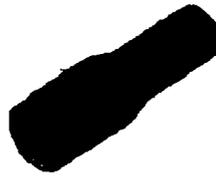
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**1/2\"/>**



**3/4\"/>**



**1\"/>**



**Branch Saddle 2\"/>**

**Dimensional Information Available Upon Request**

**Related Specifications**

- ASTM D2513
- ASTM D3350
- AWWA C906
- ASTM D3261

**Fitting Requirements**

Central's Polyethylene fusion fittings fully comply with the requirements of ASTM D2513, and ANSI/AWWA C906 and are manufactured for use with pipe conforming to ASTM D2513/3035, F-714 and with Butt fittings conforming to ASTM D3261. Central's PE fittings are molded from an NSF listed pre-blended virgin resin in accordance with the material specifications listed in ASTM D3350 with a PPI designation of 3408 and a cell classification of 345464C.

Central's PE3408 Butt Fusion Fittings are manufactured in compliance with ASTM D3261 and are compatible for heat fusion with any pipe and or fitting manufactured from a like or similar resin.

**Required Testing**

1. Minimum Hydraulic Burst Pressure Test. (ASTM D1599)
2. Sustained Pressure Test Results. (ASTM D1598)
  - Must exceed 170 hours in 80°C bath at 670 psi hoop stress (134 psig)
  - or exceed 1000 hours in 80°C bath at 580 psi hoop stress (116 psig)
  - (all above criteria are equivalent)



**ISO 9001 CERTIFIED**

**Central Plastics Company**  
 1901 W. Independence St.  
 Shawnee, OK USA 74801  
 www.centralplastics.com

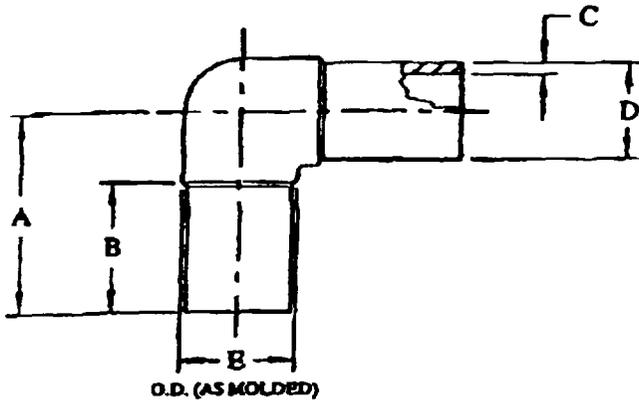
**Phone:** 800-654-3872  
 405-273-6302  
**Fax:** 800-733-5993  
 405-273-5993

# 90° ELBOW

## BUTT FUSION FITTINGS

(BUTT)

BUTTFITEL.VOL. 1  
03/1/97



O.D. (AS MOLDED)

NOMINAL SIZE	DIAMETER A	DIMENSION B	DIMENSION C	DIMENSION D	DIMENSION E
3/4" IPS (SDR 9.3)	4.00	2.625	.113 $\frac{.000}{.000}$	1.050 ± .008	1.19
3/4" IPS (SDR 11)	4.00	2.625	.141 $\frac{.000}{.000}$	1.315 ± .010	1.47
1" IPS (SDR 9.3)	4.00	2.625	.178 $\frac{.000}{.000}$	1.680 ± .010	1.84
1" IPS (SDR 11)	4.00	2.625	.204 $\frac{.000}{.000}$	1.900 ± .010	2.09
1 1/2" IPS (SDR 9.3)	4.50	2.50	.140 $\frac{.000}{.000}$	2.375 ± .010	2.63
1 1/2" IPS (SDR 11)	4.50	2.50	.216 $\frac{.000}{.000}$	2.375 ± .010	2.63
2" IPS (SDR 9.3)	5.13	3.00	.377 $\frac{.000}{.000}$	3.500 ± .012	3.88
2" IPS (SDR 11)	5.13	3.00	.318 $\frac{.000}{.000}$	3.500 ± .012	3.88
3" IPS (SDR 9.3)	5.75	3.00	.484 $\frac{.000}{.000}$	4.500 ± .015	4.80
3" IPS (SDR 11)	5.75	3.00	.408 $\frac{.000}{.000}$	4.500 ± .015	4.80
4" IPS (SDR 11)	9.00	4.38	.603 $\frac{.000}{.000}$	6.625 ± .018	6.81
6" IPS (SDR 11)	12.00	6.00	.785 $\frac{.000}{.000}$	8.625 ± .025	9.00
10" IPS (SDR 11)	13.25	6.00	.978 $\frac{.000}{.000}$	10.750 ± .027	11.25
12" IPS (SDR 11)	15.88	7.50	1.180 $\frac{.000}{.000}$	12.750 ± .036	13.25

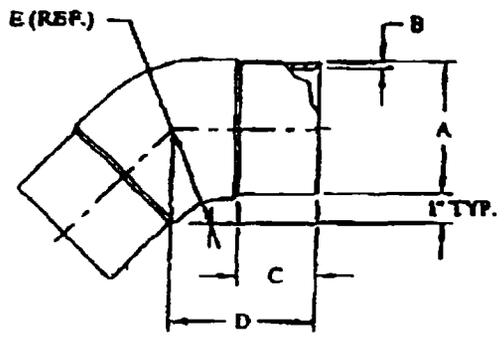
Items shown are standard sizes and wall thicknesses. Fitting sizes other than those shown can be furnished upon request.

# 45° ELBOW

## BUTT FUSION FITTINGS

(BUTT)

BUTT FUSION  
10/2/98



NOMINAL SIZE	DIAMETER A	DIMENSION B	DIMENSION C	DIMENSION D	DIMENSION E (REF.)
3" IPS (SDR 9.3)	3.500 ± 0.012	.377 <sup>+0.002</sup> / <sub>-.000</sub>	3.13	5.00	2.976
88.90mm	88.90mm	9.57mm	79.27mm	127.00mm	75.68mm
3" IPS (SDR 11)	3.500 ± 0.012	.318 <sup>+0.004</sup> / <sub>-.000</sub>	3.13	5.00	2.976
88.90mm	88.90mm	8.08mm	79.27mm	127.00mm	75.68mm
4" IPS (SDR 9.3)	4.500 ± 0.015	.484 <sup>+0.007</sup> / <sub>-.000</sub>	3.13	5.00	3.518
114.30mm	114.30mm	12.30mm	79.27mm	127.00mm	89.68mm
4" IPS (SDR 11)	4.500 ± 0.015	.409 <sup>+0.004</sup> / <sub>-.000</sub>	3.13	5.00	3.518
114.30mm	114.30mm	10.39mm	79.27mm	127.00mm	89.68mm
6" IPS (SDR 11)	6.625 ± 0.018	.603 <sup>+0.007</sup> / <sub>-.000</sub>	4.38	8.45	4.668
168.25mm	168.25mm	15.32mm	111.27mm	215.00mm	119.00mm
6" IPS (SDR 11)	6.625 ± 0.025	.785 <sup>+0.007</sup> / <sub>-.000</sub>	6.00	11.00	5.570
168.25mm	168.25mm	19.93mm	152.00mm	279.00mm	141.00mm
10" IPS (SDR 11)	10.750 ± 0.027	.978 <sup>+0.008</sup> / <sub>-.000</sub>	6.00	13.25	8.900
273.05mm	273.05mm	24.84mm	152.00mm	336.75mm	225.26mm
12" IPS (SDR 11)	12.750 ± 0.036	1.160 <sup>+0.007</sup> / <sub>-.000</sub>	7.50	15.75	7.962
323.85mm	323.85mm	29.46mm	190.50mm	400.05mm	202.92mm

Items shown are standard sizes and wall thicknesses. Fitting sizes other than those shown can be furnished upon request.

# JCM 438 All Stainless Steel Threaded Outlet Tapping Sleeve



**For taps and connections on larger pipe, thin wall pipe and pipe requiring extra reinforcement.**

The JCM 438 All Stainless Steel Threaded Outlet Tapping Sleeve is especially recommended for service connections, air relief valve connections, taps on larger A/C, Cast Iron, Ductile Iron, PVC and Reinforced Concrete Pipe. The heavy gasket section and full sleeve support of this fitting offer much more stability, pipe reinforcement and strength than a strapped saddle, yet they are competitively priced. Readily available for pipe 4" and larger requiring IPS outlets of 3/4" through 4".

### How To Order

1. Determine O.D. of pipe and outlet size.
2. Check listing to determine order number. If size is not listed, order by pipe O.D. size.

### EXAMPLE:

For 24" Cast Iron with 25.80 O.D. with 3"IP outlet, order: 438-2580 x 17IP.

## 438 ALL STAINLESS STEEL THREADED OUTLET TAPPING SLEEVE (IPS Outlet)

IPS Outlet Size	Min. O.D.	Max. O.D.	Order Number	Weight (lbs)
4	4.50		438-0450 X -	21
	4.80		438-0480 X -	21
6	6.63		438-0663 X -	23
	6.90		438-0690 X -	23
8	8.63		438-0863 X -	31
	9.05		438-0905 X -	33
10	10.75		438-1075 X -	38
	11.10		438-1110 X -	40
12	12.75		438-1275 X -	48
	13.20		438-1320 X -	51
14	14.59 - 15.08		438-1475 X -	54
	15.23 - 15.80		438-1530 X -	57
	16.30 - 16.73		438-1650 X -	60
16	17.33 - 17.87		438-1740 X -	64
	18.62 - 19.19		438-1875 X -	68
18	19.41 - 20.01		438-1950 X -	72
	20.93 - 21.57		438-2130 X -	77
20	21.51 - 22.15		438-2160 X -	80
	23.46 - 24.16		438-2400 X -	87
24	25.71 - 26.41		438-2580 X -	95
	28.14 - 28.84		438-2834 X -	104
30	31.62 - 32.22		438-3200 X -	115
36	38.10 - 38.75		438-3830 X -	139
42	44.10 - 44.70		438-4450 X -	160
48	50.40 - 51.00		438-5080 X -	183
54	56.60 - 57.25		438-5710 X -	205

IPS Outlet Size	Weight (lbs)
3/4"	06
1"	08
1-1/4"	10
1-1/2"	12
2"	14
2-1/2"	16
3"	17
4"	18

OTHER SIZES AVAILABLE UPON REQUEST.

JCM 438 All Stainless Steel Threaded Outlet Tapping Sleeve available with CC Threaded Outlet (additional charge).

### JCM 438 All Stainless Steel Threaded Outlet Tapping Sleeve Material Specifications:

**Body, Threaded Outlet, Bolts:** Stainless Steel, 18-8 Type 304. Optional 316 Stainless Steel available.

**Gasket:** Compounded for use with water, salt solutions, mild acids and bases.

2.75" x 21 parts = 57 3/4" ≈ 60" - 00"

TO LEE CROSS  
PH: 219-924-4607  
FX: 219-924-4521



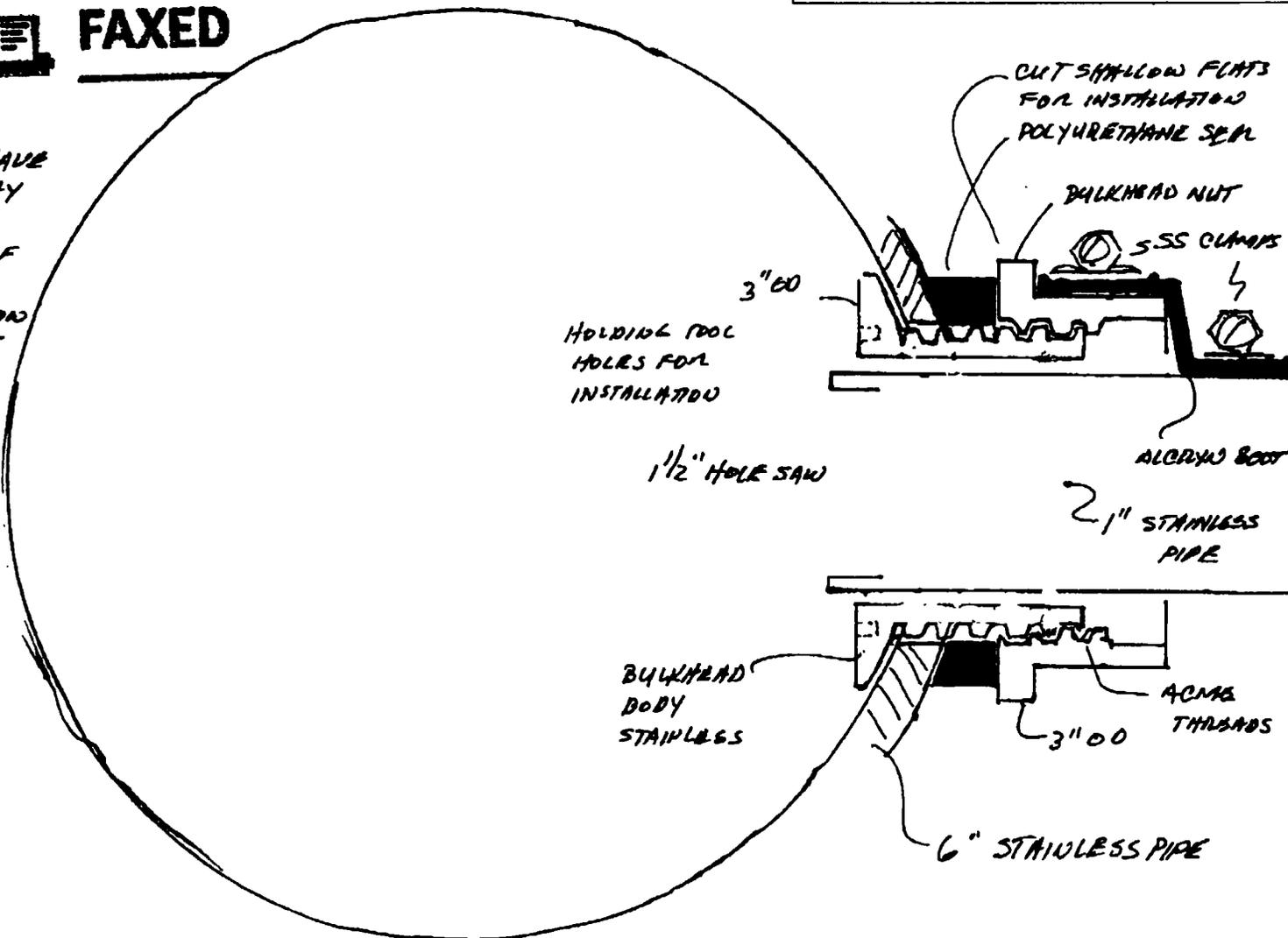
**FAXED**

Bulkhead Fitting (Custom-Fabricated)  
For Connection of Compressed Air Supply Piping to DPE wells  
System Piping Installation  
SBPA ISVE System  
cut 4/11/04

LEE: THIS WHAT I HAVE  
IN MIND. IS THIS WHAT  
YOU WANT?  
CALL TOMORROW AM IF  
THIS DESIGN IS OK,  
I CAN START TOMORROW  
PM. THEY WOULD BE  
READY NEXT WEEK  
WED-PRIOR.

LETS TALK WHEN YOU  
CAN REVIEW DWG

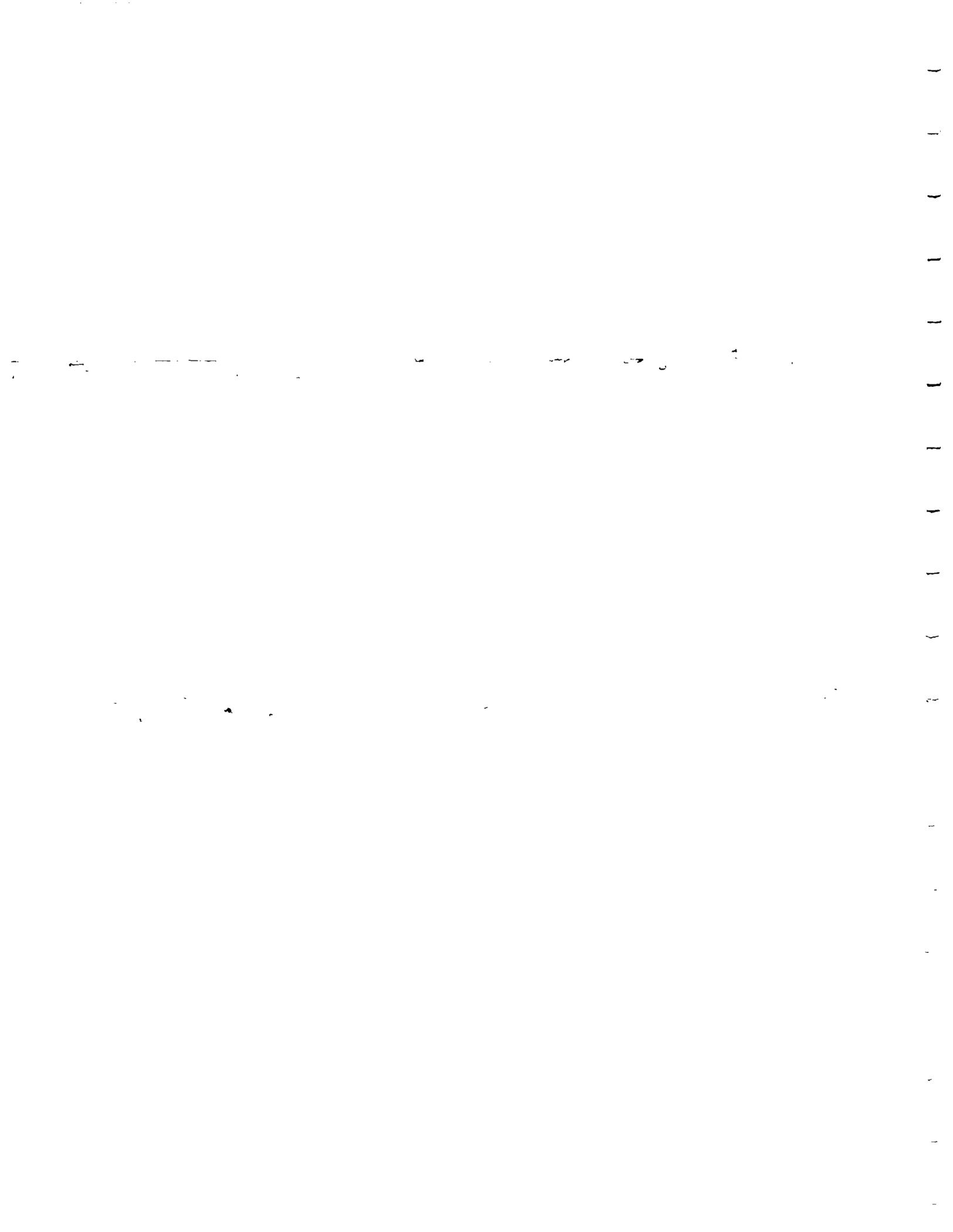
JOHN ROWE  
PH: 530-534-3966



DESIGNED FOR NEAR PERPENDICULAR ENTRY

**APPENDIX J**

**SEQUENCE OF OPERATION FOR THERMAL OXIDIZER/SCRUBBER**



I. Operating Sequence

Step	Operator Action	Effects	Remarks	
1.	Power up.	Turn on main disconnect.	Three phase power is applied to the panel and control voltage is available.	
2. Rev B	Turn on control power.  Operator Display Message:  "Control Power Off. Push Control Reset Button."	Make sure all emergency stops are pulled out. Press the Control Reset pushbutton. The Control Power on light will energize.	120VAC-control power is turned on to external devices on oxidizer.	After a delay of 15 seconds after turning on control power, alarm detection is enabled.
3.	Initiate Start-Up Sequence.  Operator Display Message:  "Press Start Button to Start System."	Operator presses the Start push-button.  Operator may abort Start up Sequence by pressing the Stop button.	System checks all safety interlocks and initiates start sequence.	

I. Operating Sequence

Step	Operator Action	Effects	Remarks
4.	Start Circulation Pump.	None. Automatic.	<p>If the water level is above the Low Low Water Level Alarm (LSLL832), the circulation pump is started and the Load Monitoring Relay starts monitoring for a dead heading condition of the pump.</p> <p>The scrubber water level is controlled by the level detector and the make up water solenoid.</p> <p>Please refer to the Set Points and Alarm Conditions section of this sequence for a full explanation.</p>
5. Rev B	<p>Circulation Flow Proving.</p> <p>Operator Display Message:</p> <p>"Recirc Pump On. System Blower Will Start Automatically."</p>	None. Automatic.	<p>With the circulation pump running both of the flow proving switches (FSL-812 and FSL-822) will close on sufficient flow.</p> <p>Allow 3-5 seconds for flow to be proven.</p> <p>The recirculation flow is monitored by the PLC. The PLC will alarm if the flow is not maintained or not made in the allotted amount of time.</p> <p>Please refer to the Set Points and Alarm Conditions section of this sequence for a complete explanation.</p>

I. Operating Sequence

Step	Operator Action	Effects	Remarks
6.	Check Scrubber Interlocks.	None. Automatic.	<p>Safeties that MUST be made before the scrubber will allow the starting of the oxidizer:</p> <ul style="list-style-type: none"> <li>a. Water level must be within safe limits (Not LSL832 or LSHH832).</li> <li>b. Recirculation pump must be on and flow to the quench and scrubber towers must be above the minimum setting of the flow switches (FSL812 and FSL822).</li> <li>c. Temperature of the scrubber must be within safe limits (TSH835).</li> </ul> <p>All these conditions MUST be met before the burner may be lit.</p> <p>Please refer to the set point and alarm section of this sequence for specific alarm information.</p>

I. Operating Sequence

Step	Operator Action	Effects	Remarks	
7.	Make-Up Water Control.	None. Automatic.	The make up water solenoid is controlled by the water level sensor (LSH832 and LSL832) and is active whenever control power is on.	Refer to the Alarm Section of this sequence for High and Low water level alarming.
8.	Start the System Fan.	None. Automatic.	The PLC will close the run contact on the VFD for the system fan.	The system waits for feedback signal from VFD indicating that the VFD is running.
9. Rev B	System Air proving.  Operator Display Message:  "Blowers Started Proving Airflow."	None. Automatic.	With the system fan running the airflow switch (PDSL103) across the system fan will close on sufficient airflow.	Allow 5-10 seconds for airflow to be proven.
10.	Start the Combustion Fan.	None. Automatic.	The PLC will start the combustion motor starter.	The system waits for feedback signal from motor starter indicating that the motor is running.

I. Operating Sequence

Step	Operator Action	Effects	Remarks	
11.	Combustion Air proving.  Operator Display Message:  "Combustion Blower Started Proving Combustion Air."	None. Automatic.	With the combustion fan running the airflow switch (PDSL244) across the burner will close on sufficient airflow.	Allow 5-10 seconds for airflow to be proven.

I. Operating Sequence

Step	Operator Action	Effects	Remarks	
12.	Burner pre-ignition requirements check.  Operator Display Message:  "Start Up Halted. Low Fire or Blocking Valve Out of Position."	None. Automatic.	With the fans on, proving switches closed and the scrubber interlocks satisfied. The controls check to assure that the system inlet damper (ZSC102) is closed and fresh air/dilution damper (ZSO104) is open.  AND  That the fuel pressure switches (PSL203 and PSH204) are satisfied.  AND  That the high limit controller (TSH121A) is not in alarm and the firing rate actuator (ZSC210) is proven closed.  AND  That the main fuel valve (ZSC207) is proven closed.	If any of the required conditions are not satisfied, burner lighting is prevented. The operator is alerted to alarm conditions via the message display.  Please refer to the set point and alarm section of this sequence for specific alarm information.

I. Operating Sequence

Step	Operator Action	Effects	Remarks	
13.	<p>Burner lighting.</p> <p>Operator Display Message:</p> <p>"Burner NOT Enabled. Press Burner Enable Button"</p> <p>"Burner Enabled. Main Flame Not Yet Established."</p>	<p>Operator presses "Burner Enable" button if the burner is not enabled.</p> <p>Burner can be enabled or disabled before this step.</p> <p>After a shutdown or if control power is shut off the burner will default to the enabled state.</p> <p>Note: Even if the burner is enabled, the burner cannot light until the pre-ignition checks are complete.</p>	<p>After the pre-ignition checks are complete, the burner controller circuit is enabled. The burner control carries out the following steps:</p> <p>a. Combustion area purge for a set time period.</p> <p>b. Burner pilot fuel valve open.</p> <p>c. Burner ignition transformer is turned on.</p> <p>d. Burner flame established.</p> <p>e. Main gas valves are opened.</p>	<p>Prior to opening of main fuel valves, the firing rate valve is held closed.</p> <p>Air is passed through the combustion area for a preset, non-adjustable, time period. (360 seconds)</p> <p>Fuel is introduced to burner.</p> <p>The spark igniter attempts to light the burner.</p> <p>The ignition spark is turned off. The flame controller assures the flame stability.</p> <p>The burner is lit and the firing rate valve is modulated to attain system ready temperature.</p> <p><i>Note:</i> Burner lighting steps are displayed on the separate flame control display on control panel.</p>





I. Operating Sequence

Step	Operator Action	Effects	Remarks	
16.	<p>Place system on-line.</p> <p>Operator Display Message:                      "System on Line. System Inlet Damper Open."</p>	<p>Open the process inlet damper by going to the Inlet Damper Screen and pressing Enable Process Inlet pushbutton on the MMI.</p> <p>When the inlet has been enabled and the customer gives the system the request to open the inlet (DI903) via Ethernet, the inlet will be opened.</p> <p>Note: On system shutdown and control power off conditions the inlet is defaulted to the Enabled position on the MMI.</p>	<p>The Process Inlet can be enabled before the system is ready. The inlet will NOT open until the ready temperature has been achieved (DO904) and the request to open (DI903) has been received via Ethernet.</p> <p>When the inlet is enabled by (DI903 and DO904), the system inlet damper is opened and fresh air / dilution damper is released to modulate.</p> <p>Positions of these dampers are checked by the PLC.</p>	<p>The oxidizer assumes the on-line configuration if the process inlet is proved open, and the system is at the "ready" operating temperatures.</p> <p>However, once the systems on-line status is achieved, the system will be placed off-line if the chamber or oxidizer outlet ready temperatures are lost. An alarm is asserted to alert the operator of this condition.</p> <p>Please refer to the set point and alarm section of this sequence for specific alarm information.</p> <p>Note: If the oxidizer was online and Ethernet communications is lost, the inlet MUST be re-enabled from the MMI inlet screen before the system can be put on-line.</p>

I. Operating Sequence

Step	Operator Action	Effects	Remarks
17.	System Fan Speed Modulation.	None. Automatic.	<p>The control loop is enabled when the system is placed on line.</p> <p>The control loop accommodates, within limits, varying process flow to the oxidizer.</p> <p>A pressure transmitter (PT101) located in the oxidizer inlet ductwork senses static pressure of the process line.</p> <p>The signal from the pressure transmitter (PT101) is fed to the PLC. The output of the PLC controller sets the system fan speed, via the fan's controlling variable frequency drive.</p> <p>The pressure loop controller, by controlling fan speed, maintains a field adjustable (within the limits of the pressure transmitter's measurement range) slightly negative pressure in the process stream. This provides the force to move the process stream through the system.</p>

I. Operating Sequence

Step	Operator Action	Effects	Remarks
17.	System Fan Speed Modulation.  (Continued)		<p>It also allows compensation for varying process flow rates. As the process flow increases, the static pressure at the sensing point would increase, given a constant system fan speed. Via the control loop, the system fan speed increases to drive the pressure down to the set point.</p> <p>As the process flow decreases, the static pressure at the sensing point would decrease, given a constant system fan speed. The pressure control loop in this case would decrease the system fan speed to drive the pressure back up to the set point.</p> <p>If the process flow drops below the minimum turndown of the system fan, the fresh air damper is modulated to maintain static pressure set point.</p>

I. Operating Sequence

Step	Operator Action	Effects	Remarks	
18.	Conductivity Blowdown Control.	None. Automatic.	The PLC monitors the conductivity of the water in the scrubber. If the conductivity of the water reaches a field adjustable set point, the controller will initiate a blowdown cycle.	When a blowdown cycle is initiated, the blowdown relay is held open for a minimum of 5 minutes and the conductivity has come back down below set point, from make up water being added to the tank.
19.	pH Control.	Automatic control of the caustic pump is enabled if the pump selector switch (in the MMI) is placed in Auto.	The PLC will monitor to assure that the circulation pump is running before it enables the caustic pump.  The PLC adjusts the stroke rate of the caustic metering pump to control the pH within a field adjustable set point range.	There is a separate PID loop in the PLC to control the caustic metering pump.  Refer to the Warning Alarm Section of this sequence for High and Low pH alarming.

I. Operating Sequence

Step	Operator Action	Effects	Remarks
20.	Taking system off-line.	<p>The controls close the process inlet damper and open the fresh air damper.</p> <p>The feedback signal from the system inlet damper limit switches indicate that the system inlet damper is closed.</p> <p>The controls disable the pressure control loop and the VFD assumes minimum speed.</p>	<p>The oxidizer may be taken off-line and again placed on-line as often as necessary.</p>
	<p>As long as the chamber temperature and the oxidizer outlet temperature remain at their respective "ready" set points, the system may be taken off-line and placed on-line at will.</p> <p>Close the process inlet damper by either going to the Inlet Damper Screen and pressing Disable Process Inlet pushbutton on the MMI OR by removing the customer request to open the inlet (DI903) via Ethernet.</p>		

I. Operating Sequence

Step	Operator Action	Effects	Remarks	
21.	System shut down.  Operator Display Message:  "System Shutting Off. Burner Off in XX Seconds."	Press the System Stop pushbutton.	<p>The oxidizer enters into the shutdown routine.</p> <p>If the system is on-line, the controls close the system inlet damper. The fresh air/dilution damper is opened and the pressure control loop is disabled. The signal (DO904), which indicates the system is ready for the process stream, changes states.</p> <p>The oxidizer temperature is maintained for five (5) minutes to remove any residue left in the system.</p> <p>The burner is then shut off and the chamber temperature is monitored.</p>	<p>Operator interface indicates shutdown and burner and fan running status during shutdown procedure.</p> <p>Note: At any time during the shutdown sequence, the operator can re-start the system by simply pressing the System Start pushbutton on the MMI.</p> <p><u>Note:</u> If the burner was NOT on when the System Stop button was pressed, the system will still monitor the chamber temperature.</p>

I. Operating Sequence

Step	Operator Action	Effects	Remarks
21.	System shut down.  (Continued)  Operator Display Message:  "When System Below 150F, Blowers Will Shut Off."	When the chamber temperature drops below 150°F the system and combustion fans are turned off.  After the system and combustion fans are shut off the circulation pump is shut off.	If the system temperature is <u>above</u> 150°F, the system and combustion fans remain on.  If the system temperature is <u>below</u> 150°F, then the system and combustion fans are shut off.  If the scrubber high temperature alarm is asserted the circulation pump will be restarted.
22.	System shutdown completion.  Operator Display Message:  "Oxidizer Shutdown Complete. Press Reset to Enable System Restart."	Press the Reset button to enable re-starting of the system.	

II. Set Points and Alarm Conditions

Process Set Point or Alarm Condition	Value or Trip Condition	Explanation
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<p><b>Key:</b></p>		<p><b>Warning Alarm:</b>            The alarm horn, alarm light and alarm relay are activated. The system takes no other action.</p> <p><b>Off Line Alarm:</b>            The alarm horn, alarm light and alarm relay are activated. If the system was on line (system inlet damper open), the system is taken off-line. The system takes no other action.</p> <p><b>Shutdown Alarm:</b>            The alarm horn, alarm light and alarm relay are activated. The burner is shut off. The ready relay is de-energized and the system enters the shutdown sequence.</p> <p><b>Hard Shutdown Alarm:</b>            The alarm horn, alarm light and alarm relay are activated. All PLC controlled devices are shutdown. This is similar to pressing an E-Stop pushbutton.</p> <p><b>Set Point:</b>            The value that is to be entered in the MMI, set in a controller or the value that a physical switch must be scaled/set to.</p>
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II. Set Points and Alarm Conditions

Process Set Point or Alarm Condition	Value or Trip Condition	Explanation
Scrubber Circulation Pump Not On or Overload Has Tripped  <b>Hard Shutdown Alarm</b> RevB	XSH-800 JSL-800	The PLC has tried to start the scrubber circulation pump and has not received the pump running contact back in the allotted amount of time. Or, the pump was running and unexpectedly shuts off.
Scrubber / Quench Low Flow  <b>Hard Shutdown Alarm</b>	FSL-812 FSL-822	Any time the scrubber circulation pump is running the flow in the quench tower and the scrubber are monitored. If the system is running and a loss of flow is detected, a hard shutdown alarm is asserted.  If the flow switches are not proven, the oxidizer is not permitted to run.
High Scrubber Water Level  <b>Shutdown Alarm</b>	LSHH-832	The water level in the scrubber has risen and tripped the high level switch. The system is shutdown.  Check the over flow pipe to assure that it has not clogged.
Low Scrubber Water Level  <b>Hard Shutdown Alarm</b>	LSSL-832	The water level in the scrubber has fallen to the point where the low level switch is no longer made.  <b>This alarm condition shuts off the circulation pump, thus shutting down the system.</b>
System Inlet Damper Position  <b>Warning Alarm Shutdown Alarm</b>	ZSO-102 ZSC-102	A start up sequence was initiated or the system was taken off-line. The system inlet was not proven closed. These contacts are in series to prove the safe condition of the damper.  The system was put on-line. The system inlet was not proven open. These contacts are in series to prove on-line condition of the damper.

**II. Set Points and Alarm Conditions**

Process Set Point or Alarm Condition	Value or Trip Condition	Explanation
Fresh Air Damper Position  <b>Warning Alarm</b>	ZSO-104	The PLC has commanded the fresh air damper to open and the PLC has not received the open signal back from the damper.
PH Level  <b>Set Point</b>	7.0  AIC-802	The pH level in the scrubber is controlled by a single PID loop in the PLC. The set point is adjustable through the MMI.
High pH Level  <b>Warning Alarm Shutdown Alarm</b>	8.5  ASH-802	The pH level in the scrubber has risen above the set point in the PLC. The pH set point is adjustable through the MMI.  If pH remains at or above this set point for ten (10) minutes the system is shutdown.
Low pH Level  <b>Warning Alarm Shutdown Alarm</b>	6.0  ASL-802	The pH level in the scrubber has fallen below the set point in the PLC. The pH set point is adjustable through the MMI.  If pH remains at or below this set point for ten (10) minutes the system is shutdown.
Scrubber High Temperature Limit  <b>Hard Shutdown Alarm</b>  RevB	180°F  TSH-835	The temperature in the scrubber has risen to an unacceptable level. To protect the packing material in the scrubber tower the system is shutdown except for the circulation pump. If the system is not running or shutdown and this alarm is asserted, the circulation pump will restart.  The emergency water solenoid (SV814) is energized and stays on as long as this alarm is active. If the alarm is reset and the alarm reasserts itself, the emergency water solenoid is energized again.

**II. Set Points and Alarm Conditions**

Process Set Point or Alarm Condition	Value or Trip Condition	Explanation
System Fan Motor Overload  <b>Shutdown Alarm</b>	XSO-105	The system fan VFD was turned on by the PLC. The PLC did not see the running contact close in the allotted amount of time. Or the VFD was running and unexpectedly shuts off.
System Low Air Flow  <b>Shutdown Alarm</b>	PDSL-103	The PLC has started the system fan. The differential switch across the blower has not proven, or the switch had been closed and unexpectedly opened.
Combustion Fan Motor Overload  <b>Shutdown Alarm</b>	XSO-240	The combustion fan was turned on by the PLC. The PLC did not see the running contact close in the allotted amount of time. Or the motor was running and unexpectedly shuts off.
Combustion Low Air Flow  <b>Shutdown Alarm</b>	PDSL-244	The PLC has started the combustion fan. The differential switch across the burner has not proven, or the switch had been closed and unexpectedly opened.
Conductivity Blowdown  <b>Set Point</b>	50 microsiemens  ASH-803	When the conductivity in the scrubber rises to this set point, the blow down solenoid is opened. When the conductivity drops, due to fresh water filling the scrubber tank, the blow down solenoid is closed.  The conductivity blowdown set point is set in the MMI.

**II. Set Points and Alarm Conditions**

Process Set Point or Alarm Condition	Value or Trip Condition	Explanation
<p>High Conductivity</p> <p><b>Warning Alarm</b></p> <p><b>Shutdown Alarm</b></p>	<p>80 microsiemens</p> <p>ASHH-803</p>	<p>The conductivity in the scrubber has risen above the set point in the conductivity analyzer.</p> <p>If the conductivity is at or above this set point for ten (10) minutes the system is shutdown.</p> <p><i>Note:</i> The blowdown set point should be set lower than the conductivity alarm set point so that a blowdown sequence can be initiated before this alarm is asserted.</p>
<p>Chamber Temperature</p> <p><b>Set Point</b></p> <p>RevB</p>	<p>1600°F</p> <p>TIC-121C</p>	<p>This is the initial temperature at which the firing rate actuator will modulate to try to attain and hold. This setting will be adjusted during commissioning based on VOC loading.</p> <p>Control for this PID loop is located in the PLC and the settings are adjustable through the MMI.</p>
<p>High / Low Gas Pressure</p> <p><b>Shutdown Alarm</b></p>	<p>PAL-203</p> <p>PDAH-204</p>	<p>The fuel pressure has either risen above or fallen below the set points on the gas pressure switches. These set points are adjustable on the switches themselves.</p> <p>These pressure switches are required safety devices and should never be bypassed.</p>
<p>Flame Failure</p> <p><b>Shutdown Alarm</b></p>	<p>FSC-235</p>	<p>The flame safety relay has faulted.</p> <p>Please refer to the flame safety literature in your owner's manual for the specific fault code information.</p> <p>Flame safety relay information is displayed on the main control panel via the flame safety relay display module.</p>

**II. Set Points and Alarm Conditions**

Process Set Point or Alarm Condition	Value or Trip Condition	Explanation
<p>System Ready</p> <p><b>Set Point</b></p>	<p>1450°F</p> <p>TSL-121C</p>	<p>This set point will be compared to the thermocouple that monitors chamber temperature.</p> <p>The system is considered ready when the chamber temperature is at or above this temperature for three (3) minutes.</p> <p>The unit cannot be placed on-line until chamber and oxidizer outlet ready temperatures have been reached.</p>
<p>Loss of System Ready Temperature</p> <p><b>Off Line Alarm</b></p>	TSL-121C	<p>The system is on-line and the chamber temperature has dropped below the ready temperature set point for five (5) minutes. The system is taken off-line.</p>
<p>Oxidizer Outlet Ready</p> <p><b>Set Point</b></p>	<p>750°F</p> <p>TSL-124</p>	<p>This set point will be compared to the thermocouple that monitors the oxidizer outlet air temperature.</p> <p>The oxidizer outlet air temperature is considered ready when the air stream temperature is at or above this temperature for three (3) minutes.</p> <p>The unit cannot be placed on-line until the chamber and oxidizer outlet ready temperatures have been reached.</p>
<p>Loss of Oxidizer Outlet Ready Temperature</p> <p><b>Off Line Alarm</b></p>	TSL-124	<p>The system is on-line and the oxidizer outlet temperature has dropped below the ready temperature set point for five (5) minutes. The system is taken off-line.</p>
<p>High Chamber Temperature (Internal to the PLC)</p> <p><b>Shutdown Alarm</b> RevB</p>	<p>1750°F</p> <p>TSH-121C</p>	<p>The chamber temperature has risen above the chamber high temperature set point in the PLC, adjustable through the MMI.</p>

II. Set Points and Alarm Conditions

Process Set Point or Alarm Condition	Value or Trip Condition	Explanation
High Chamber Temperature Limit Tripped  <b>Shutdown Alarm</b>  RevB	1750°F  TAH-121A	The chamber temperature has risen above the chamber high temperature set point in the limit controller.  The temperature high limit controller is a required safety device and should never be bypassed.
Oxidizer Outlet High Temperature  <b>Shutdown Alarm</b> RevB	950°F  TSH-124	The oxidizer outlet temperature has risen above the outlet high temperature set point in the PLC, adjustable through the MMI.
Excess Negative Pressure Fault  <b>Hard Shutdown Alarm</b> RevB	-1PSI  PSL-106	The negative pressure at the system fan inlet has risen above the setting on the excess negative pressure switch. This switch is meant to protect the ductwork and should never be bypassed.
System Low Pressure  <b>Set Point Warning Alarm</b> RevB	-5.0" w.c.  PSL-101	The pressure control loop for the system VFD is active and the process pressure has not attained acceptable limits. After a sixty (60) second delay, an alarm is asserted.
System High Pressure  <b>Set Point Warning Alarm</b> RevB	1.0" w.c.  PSH-101	The pressure control loop for the system VFD is active and the process pressure has not attained acceptable limits. After a sixty (60) second delay, an alarm is asserted.
High Scrubber Differential Pressure  <b>Warning Alarm</b>  RevB	3.5" w.c.  PDSH-816	The differential pressure across the packing material in the scrubber has risen to an abnormal level.  A physical inspection of the packing material should be conducted.

**II. Set Points and Alarm Conditions**

Process Set Point or Alarm Condition	Value or Trip Condition	Explanation
Blowdown Has Hit 750,000 Gal. <b>Warning Alarm</b>	750,000 Gal FQH-846	The blowdown accumulator has reached 750,000 gallons and has not been reset. Reset the blowdown accumulator by going to the Analog screen and pressing the Blowdown Reset pushbutton.
Blowdown Has Hit 999,999 Gal And Was Reset <b>Warning Alarm</b>	999,999 Gal FQHH-846	The blowdown accumulator has reached 999,999 gallons and has been reset to 0.

**APPENDIX K**

**THERMAL OXIDIZER/SCRUBBER SYSTEM QUALITY CONTROL RESULTS**

**Summary of Quality Control Testing, System Startup  
Thermal Oxidizer/Scrubber System (Therm Ox 2)  
ACS NPL Site  
Griffith, Indiana**

Compound	Sampled 5/27/03			
	Units	Inlet	Outlet	Destruction Efficiency (%)
<b>Modified TO-15</b>				
Chloromethane	ppbv	ND	1.4	NC
Vinyl Chloride	ppbv	ND	ND	NC
Bromomethane	ppbv	ND	ND	NC
Chloroethane	ppbv	ND	1	NC
Acetone	ppbv	51,000	38	99.93%
Trichlorofluoromethane	ppbv	4,900	ND	100.00%
1,1-Dichloroethene	ppbv	ND	0.89	100.00%
Methylene Chloride	ppbv	65,000	0.64	100.00%
Trichlorofluoroethane	ppbv	9,300	0.38	100.00%
Carbon Disulfide	ppbv	5,600	3.3	99.94%
trans-1,2-Dichloroethene	ppbv	ND	ND	NC
1,1-Dichloroethane	ppbv	9,900	ND	100.00%
Methyl tert-Butyl Ether	ppbv	ND	ND	NC
Vinyl Acetate	ppbv	ND	2.2	NC
2-Butanone (MEK)	ppbv	44,000	7.3	99.98%
cis-1,2-Dichloroethene	ppbv	20,000	ND	100.00%
Chloroform	ppbv	4,500	ND	100.00%
1,2-Dichloroethane	ppbv	ND	ND	NC
1,1,1-Trichloroethane	ppbv	67,000	ND	100.00%
Benzene	ppbv	50,000	1.6	100.00%
Carbon Tetrachloride	ppbv	ND	ND	NC
1,2-Dichloropropane	ppbv	ND	ND	NC
Bromodichloromethane	ppbv	ND	ND	NC
Trichloroethene	ppbv	35,000	0.46	100.00%
cis-1,3-Dichloropropene	ppbv	ND	ND	NC
4-Methyl-2-pentanone	ppbv	19,000	ND	100.00%
trans-1,3-Dichloropropene	ppbv	ND	ND	NC
1,1,2-Trichloroethane	ppbv	ND	ND	NC
Toluene	ppbv	200,000	6.8	100.00%
2-Hexanone	ppbv	ND	0.89	NC
Dibromochloromethane	ppbv	ND	ND	NC
1,2-Dibromoethane	ppbv	ND	ND	NC
Tetrachloroethene	ppbv	27,000	0.78	100.00%
Chlorobenzene	ppbv	ND	ND	NC
Ethylbenzene	ppbv	17,000	1.2	99.99%
m,p-Xylenes	ppbv	75,000	7.3	99.99%
Bromoform	ppbv	ND	ND	NC
Styrene	ppbv	ND	ND	NC
o-Xylene	ppbv	23,000	2	99.99%
1,1,2,2-Tetrachloroethane	ppbv	ND	ND	NC
1,3-Dichlorobenzene	ppbv	ND	ND	NC
1,4-Dichlorobenzene	ppbv	ND	ND	NC
1,2-Dichlorobenzene	ppbv	ND	ND	NC
<b>Total</b>	<b>ppbv</b>	<b>727,200.00</b>	<b>76.14</b>	<b>99.99%</b>
<b>Total</b>	<b>lb/hr</b>	<b>8.86</b>	<b>0.00088</b>	<b>99.99%</b>

Compounds	Units	Inlet	Outlet	Destruction Efficiency (%)
<b>Modified Method 25C</b>				
Methane	ppmv	290	ND	100.00%
Total Gaseous Non-Methane Organics (as Methane)	ppmv	12,000	ND	100.00%

Notes:

NC - Not calculated

ND - Not detected

ppbv - parts per billion by volume

ppmv - parts per million by volume

lb/hr - pounds per hour



Client:	ANGUIL ENVIRONMENTAL SYSTEMS	Date of Report:	06/13/03
Address:	8855 North 55th Street	Date Received:	05/28/03
	Milwaukee, WI 53223-2358	CAS Project No:	P2301012
Contact:	Mr. Bob Lien	Purchase Order:	27702
Client Project ID: <u>MWH/10908</u>			

Two (2) Stainless Steel Summa Canisters labeled: "MWH 10908 Inlet" and "MWH 10908 Outlet"

The samples were received at the laboratory under chain of custody on May 28, 2003. The samples were received intact. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time that they were received at the laboratory.

Methane and Total Gaseous Non-Methane Organics Analysis

The samples were analyzed for methane and total gaseous non-methane organics according to modified EPA Method 25C. The analyses included a single sample injection (method modification) analyzed by gas chromatography using flame ionization detection/total combustion analysis.

Reviewed and Approved:

*Michelle H. Sakamoto*

Michelle Sakamoto  
Analytical Chemist  
Air Quality Laboratory

Reviewed and Approved:

*Wade Henton*

Wade Henton  
GC-VOA Team Leader  
Air Quality Laboratory

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1 of 15



CAS Project No: P2301012

Volatile Organic Compound Analysis

The samples were also analyzed by combined gas chromatography/mass spectrometry (GC/MS) for volatile organic compounds. The analyses were performed according to the methodology outlined in EPA Method TO-15. The Summa canisters were pressurized with helium (method modification), and the analyses were performed by gas chromatography/mass spectrometry, utilizing a direct cryogenic trapping technique. The analytical system used was comprised of a Hewlett Packard Model 5972 GC/MS/DS interfaced to a Tekmar AutoCan Elite whole air inlet system/cryogenic concentrator. A 100% Dimethylpolysiloxane capillary column (RT<sub>x</sub>-1, Restek Corporation, Bellefonte, PA) was used to achieve chromatographic separation.

The results of analyses are given on the attached data sheets. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for utilization of less than the complete report.

**COLUMBIA ANALYTICAL SERVICES, INC.**

**RESULTS OF ANALYSIS**

Page 1 of 1

Client: **Anguil Environmental Systems**  
 Client Sample ID: **MWH 10908 Inlet**  
 Client Project ID: **MWH/10908**

CAS Project ID: **P2301012**  
 CAS Sample ID: **P2301012-001**

Test Code: **Modified EPA Method 25C**  
 Instrument ID: **HP5890/FID/TCA**  
 Analyst: **Michele Hickman/Wade Henton**  
 Sampling Media: **Summa Canister**  
 Test Notes:  
 Container ID: **SC00413**

Date Collected: **5/27/03**  
 Date Received: **5/28/03**  
 Date Analyzed: **5/30/03**  
 Volume(s) Analyzed: **0.064 ml**

Pi 1 = -2.2      Pf 1 = 3.5  
 D.F. = 1.46

CAS #	Compound	Result ppmV	MRL ppmV	Data Qualifier
74-82-8	Methane	290	5.7	
	Total Gaseous Non-Methane Organics (as Methane)	12,000	11	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: ME      Date: 06/10/03

**COLUMBIA ANALYTICAL SERVICES, INC.**

**RESULTS OF ANALYSIS**

Page 1 of 1

**Client:** Angull Environmental Systems  
**Client Sample ID:** MWH 10908 Outlet  
**Client Project ID:** MWH/10908

**CAS Project ID:** P2301012  
**CAS Sample ID:** P2301012-002

**Test Code:** Modified EPA Method 25C  
**Instrument ID:** HP5890/FID/TCA  
**Analyst:** Michele Hickman/Wade Henton  
**Sampling Media:** Summa Canister  
**Test Notes:**  
**Container ID:** SC00281

**Date Collected:** 5/27/03  
**Date Received:** 5/28/03  
**Date Analyzed:** 5/30/03  
**Volume(s) Analyzed:** 0.50 ml

P11 = -4.0      P11 = 3.5  
 D.F. = 1.70

CAS #	Compound	Result ppmV	MRL ppmV	Data Qualifier
74-82-8	Methane	ND	0.85	
	Total Gaseous Non-Methane Organics (as Methane)	ND	1.7	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: me      Date: 06/10/03

**COLUMBIA ANALYTICAL SERVICES, INC.**

**RESULTS OF ANALYSIS**

Page 1 of 1

**Client:** Angull Environmental Systems  
**Client Sample ID:** Method Blank  
**Client Project ID:** MWH/10908

**CAS Project ID:** P2301012  
**CAS Sample ID:** P030530-MB

**Test Code:** Modified EPA Method 25C  
**Instrument ID:** HP5890/FID/TCA  
**Analyst:** Michele Hickman/Wade Henton  
**Sampling Media:** Summa Canister  
**Test Notes:**

**Date Collected:** NA  
**Date Received:** NA  
**Date Analyzed:** 5/30/03  
**Volume(s) Analyzed:** 0.50 ml

D.F. = 1.00

CAS #	Compound	Result ppmV	MRL ppmV	Data Qualifier
74-82-8	Methane	ND	0.50	
	Total Gaseous Non-Methane Organics (as Methane)	ND	1.0	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By:           FME           Date:           06/10/03

**COLUMBIA ANALYTICAL SERVICES, INC.**

**RESULTS OF ANALYSIS**

Page 1 of 2

Client: **Angull Environmental Systems**  
 Client Sample ID: **MWH 10908 Inlet**  
 Client Project ID: **MWH/10908**

CAS Project ID: **P2301012**  
 CAS Sample ID: **P2301012-001**

Test Code: **Modified EPA TO-15**  
 Instrument ID: **HP5972/Tekmar AUTOCAN Elite**  
 Analyst: **Michelle Sakamoto**  
 Sampling Media: **Summa Canister**  
 Test Notes:  
 Container ID: **SC00413**

Date Collected: **5/27/03**  
 Date Received: **5/28/03**  
 Date(s) Analyzed: **6/6/03**  
 Volume(s) Analyzed: **0.00010 Liter(s)**

Pi 1 = -2.2 Pf 1 = 3.5

D.F. = 1.46

CAS #	Compound	Result µg/m <sup>3</sup>	MRL µg/m <sup>3</sup>	Result ppbV	MRL ppbV	Data Qualifier
74-87-3	Chloromethane	ND	15,000	ND	7,100	
75-01-4	Vinyl Chloride	ND	15,000	ND	5,700	
74-83-9	Bromomethane	ND	15,000	ND	3,800	
75-00-3	Chloroethane	ND	15,000	ND	5,500	
67-64-1	Acetone	120,000	73,000	51,000	31,000	
75-69-4	Trichlorofluoromethane	27,000	15,000	4,900	2,600	
75-35-4	1,1-Dichloroethene	ND	15,000	ND	3,700	
75-09-2	Methylene chloride	230,000	15,000	65,000	4,200	
76-13-1	Trichlorotrifluoroethane	71,000	15,000	9,300	1,900	
75-15-0	Carbon Disulfide	18,000	15,000	5,600	4,700	
156-60-5	trans-1,2-Dichloroethene	ND	15,000	ND	3,700	
75-34-3	1,1-Dichloroethane	40,000	15,000	9,900	3,600	
1634-04-4	Methyl tert-Butyl Ether	ND	15,000	ND	4,100	
108-05-4	Vinyl Acetate	ND	15,000	ND	4,100	
78-93-3	2-Butanone (MEK)	130,000	15,000	44,000	5,000	
156-59-2	cis-1,2-Dichloroethene	80,000	15,000	20,000	3,700	
67-66-3	Chloroform	22,000	15,000	4,500	3,000	
107-06-2	1,2-Dichloroethane	ND	15,000	ND	3,600	
71-55-6	1,1,1-Trichloroethane	360,000	15,000	67,000	2,700	
71-43-2	Benzene	160,000	15,000	50,000	4,600	
56-23-5	Carbon Tetrachloride	ND	15,000	ND	2,300	
78-87-5	1,2-Dichloropropane	ND	15,000	ND	3,200	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: KNE Date: 06/10/03

**COLUMBIA ANALYTICAL SERVICES, INC.**

**RESULTS OF ANALYSIS**

Page 2 of 2

**Client:** Anguil Environmental Systems  
**Client Sample ID:** MWH 10908 Inlet  
**Client Project ID:** MWH/10908

**CAS Project ID:** P2301012  
**CAS Sample ID:** P2301012-001

**Test Code:** Modified EPA TO-15  
**Instrument ID:** HP5972/Tekmar AUTOCAN Elite  
**Analyst:** Michelle Sakamoto  
**Sampling Media:** Summa Canister  
**Test Notes:**  
**Container ID:** SC00413

**Date Collected:** 5/27/03  
**Date Received:** 5/28/03  
**Date(s) Analyzed:** 6/6/03  
**Volume(s) Analyzed:** 0.00010 Liter(s)

Pi 1 = -2.2 Pf 1 = 3.5

D.F. = 1.46

CAS #	Compound	Result µg/m <sup>3</sup>	MRL µg/m <sup>3</sup>	Result ppbV	MRL ppbV	Data Qualifier
75-27-4	Bromodichloromethane	ND	15,000	ND	2,200	
79-01-6	Trichloroethene	190,000	15,000	35,000	2,700	
10061-01-5	cis-1,3-Dichloropropene	ND	15,000	ND	3,200	
108-10-1	4-Methyl-2-pentanone	76,000	15,000	19,000	3,600	
10061-02-6	trans-1,3-Dichloropropene	ND	15,000	ND	3,200	
79-00-5	1,1,2-Trichloroethane	ND	15,000	ND	2,700	
108-88-3	Toluene	740,000	15,000	200,000	3,900	
591-78-6	2-Hexanone	ND	15,000	ND	3,600	
124-48-1	Dibromochloromethane	ND	15,000	ND	1,700	
106-93-4	1,2-Dibromoethane	ND	15,000	ND	1,900	
127-18-4	Tetrachloroethene	180,000	15,000	27,000	2,200	
108-90-7	Chlorobenzene	ND	15,000	ND	3,200	
100-41-4	Ethylbenzene	75,000	15,000	17,000	3,400	
136777-61-2	m,p-Xylenes	330,000	15,000	75,000	3,400	
75-25-2	Bromoform	ND	15,000	ND	1,400	
100-42-5	Styrene	ND	15,000	ND	3,400	
95-47-6	o-Xylene	99,000	15,000	23,000	3,400	
79-34-5	1,1,2,2-Tetrachloroethane	ND	15,000	ND	2,100	
541-73-1	1,3-Dichlorobenzene	ND	15,000	ND	2,400	
106-46-7	1,4-Dichlorobenzene	ND	15,000	ND	2,400	
95-50-1	1,2-Dichlorobenzene	ND	15,000	ND	2,400	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: EME Date: 06/10/03



## COLUMBIA ANALYTICAL SERVICES, INC.

## RESULTS OF ANALYSIS

Page 2 of 2

Client: **Angull Environmental Systems**  
 Client Sample ID: **MWH 10908 Outlet**  
 Client Project ID: **MWH/10908**

CAS Project ID: **P2301012**  
 CAS Sample ID: **P2301012-002**

Test Code: **Modified EPA TO-15**  
 Instrument ID: **HP5972/Tekmar AUTOCAN Elite**  
 Analyst: **Michelle Sakamoto**  
 Sampling Media: **Summa Canister**  
 Test Notes:  
 Container ID: **SC00281**

Date Collected: **5/27/03**  
 Date Received: **5/28/03**  
 Date(s) Analyzed: **6/5/03**  
 Volume(s) Analyzed: **1.00 Liter(s)**

Pi 1 = -4.0      Pf 1 = 3.5

D.F. = 1.70

CAS #	Compound	Result µg/m <sup>3</sup>	MRL µg/m <sup>3</sup>	Result ppbV	MRL ppbV	Data Qualifier
75-27-4	Bromodichloromethane	ND	1.7	ND	0.25	
79-01-6	Trichloroethene	2.4	1.7	0.46	0.32	
10061-01-5	cis-1,3-Dichloropropene	ND	1.7	ND	0.37	
108-10-1	4-Methyl-2-pentanone	ND	1.7	ND	0.42	
10061-02-6	trans-1,3-Dichloropropene	ND	1.7	ND	0.37	
79-00-5	1,1,2-Trichloroethane	ND	1.7	ND	0.31	
108-88-3	Toluene	26	1.7	6.8	0.45	
591-78-6	2-Hexanone	3.7	1.7	0.89	0.42	
124-48-1	Dibromochloromethane	ND	1.7	ND	0.20	
106-93-4	1,2-Dibromoethane	ND	1.7	ND	0.22	
127-18-4	Tetrachloroethene	5.3	1.7	0.78	0.25	
108-90-7	Chlorobenzene	ND	1.7	ND	0.37	
100-41-4	Ethylbenzene	5.4	1.7	1.2	0.39	
136777-61-2	m,p-Xylenes	32	1.7	7.3	0.39	
75-25-2	Bromoform	ND	1.7	ND	0.16	
100-42-5	Styrene	ND	1.7	ND	0.40	
95-47-6	o-Xylene	8.5	1.7	2.0	0.39	
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.7	ND	0.25	
541-73-1	1,3-Dichlorobenzene	ND	1.7	ND	0.28	
106-46-7	1,4-Dichlorobenzene	ND	1.7	ND	0.28	
95-50-1	1,2-Dichlorobenzene	ND	1.7	ND	0.28	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: EMR Date: 06/10/03

## COLUMBIA ANALYTICAL SERVICES, INC.

## RESULTS OF ANALYSIS

Page 1 of 2

Client: **Angull Environmental Systems**  
 Client Sample ID: **Method Blank**  
 Client Project ID: **MWE/10908**

CAS Project ID: **P2301012**  
 CAS Sample ID: **P030604-MB**

Test Code: **Modified EPA TO-15**  
 Instrument ID: **HP5972/Tekmar AUTOCAN Elite**  
 Analyst: **Michelle Sakamoto**  
 Sampling Media: **Summa Canister**  
 Test Notes:

Date Collected: **NA**  
 Date Received: **NA**  
 Date(s) Analyzed: **6/4/03**  
 Volume(s) Analyzed: **1.00 Liter(s)**

D.F. = 1.00

CAS #	Compound	Result $\mu\text{g}/\text{m}^3$	MRL $\mu\text{g}/\text{m}^3$	Result ppbV	MRL ppbV	Data Qualifier
74-87-3	Chloromethane	ND	1.0	ND	0.48	
75-01-4	Vinyl Chloride	ND	1.0	ND	0.39	
74-83-9	Bromomethane	ND	1.0	ND	0.26	
75-00-3	Chloroethane	ND	1.0	ND	0.38	
67-64-1	Acetone	ND	5.0	ND	2.1	
75-69-4	Trichlorofluoromethane	ND	1.0	ND	0.18	
75-35-4	1,1-Dichloroethene	ND	1.0	ND	0.25	
75-09-2	Methylene chloride	ND	1.0	ND	0.29	
76-13-1	Trichlorotrifluoroethane	ND	1.0	ND	0.13	
75-15-0	Carbon Disulfide	ND	1.0	ND	0.32	
156-60-5	trans-1,2-Dichloroethene	ND	1.0	ND	0.25	
75-34-3	1,1-Dichloroethane	ND	1.0	ND	0.25	
1634-04-4	Methyl tert-Butyl Ether	ND	1.0	ND	0.28	
108-05-4	Vinyl Acetate	ND	1.0	ND	0.28	
78-93-3	2-Butanone (MEK)	ND	1.0	ND	0.34	
156-59-2	cis-1,2-Dichloroethene	ND	1.0	ND	0.25	
67-66-3	Chloroform	ND	1.0	ND	0.20	
107-06-2	1,2-Dichloroethane	ND	1.0	ND	0.25	
71-55-6	1,1,1-Trichloroethane	ND	1.0	ND	0.18	
71-43-2	Benzene	ND	1.0	ND	0.31	
56-23-5	Carbon Tetrachloride	ND	1.0	ND	0.16	
78-87-5	1,2-Dichloropropane	ND	1.0	ND	0.22	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: ME Date: 06/10/03

## COLUMBIA ANALYTICAL SERVICES, INC.

## RESULTS OF ANALYSIS

Page 2 of 2

Client: **Angull Environmental Systems**  
 Client Sample ID: **Method Blank**  
 Client Project ID: **MWH/10908**

CAS Project ID: **P2301012**  
 CAS Sample ID: **P030604-MB**

Test Code: **Modified EPA TO-15**  
 Instrument ID: **HP5972/Tekmar AUTOCAN Elite**  
 Analyst: **Michelle Sakamoto**  
 Sampling Media: **Summa Canister**  
 Test Notes:

Date Collected: **NA**  
 Date Received: **NA**  
 Date(s) Analyzed: **6/4/03**  
 Volume(s) Analyzed: **1.00 Liter(s)**

D.F. = 1.00

CAS #	Compound	Result $\mu\text{g}/\text{m}^3$	MRL $\mu\text{g}/\text{m}^3$	Result ppbV	MRL ppbV	Data Qualifier
75-27-4	Bromodichloromethane	ND	1.0	ND	0.15	
79-01-6	Trichloroethene	ND	1.0	ND	0.19	
10061-01-5	cis-1,3-Dichloropropene	ND	1.0	ND	0.22	
108-10-1	4-Methyl-2-pentanone	ND	1.0	ND	0.24	
10061-02-6	trans-1,3-Dichloropropene	ND	1.0	ND	0.22	
79-00-5	1,1,2-Trichloroethane	ND	1.0	ND	0.18	
108-88-3	Toluene	ND	1.0	ND	0.27	
591-78-6	2-Hexanone	ND	1.0	ND	0.24	
124-48-1	Dibromochloromethane	ND	1.0	ND	0.12	
106-93-4	1,2-Dibromoethane	ND	1.0	ND	0.13	
127-18-4	Tetrachloroethene	ND	1.0	ND	0.15	
108-90-7	Chlorobenzene	ND	1.0	ND	0.22	
100-41-4	Ethylbenzene	ND	1.0	ND	0.23	
136777-61-2	m,p-Xylenes	ND	1.0	ND	0.23	
75-25-2	Bromoform	ND	1.0	ND	0.097	
100-42-5	Styrene	ND	1.0	ND	0.23	
95-47-6	o-Xylene	ND	1.0	ND	0.23	
79-34-5	1,1,2,2-Tetrachloroethane	ND	1.0	ND	0.15	
541-73-1	1,3-Dichlorobenzene	ND	1.0	ND	0.17	
106-46-7	1,4-Dichlorobenzene	ND	1.0	ND	0.17	
95-50-1	1,2-Dichlorobenzene	ND	1.0	ND	0.17	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: eme Date: 06/10/03

**COLUMBIA ANALYTICAL SERVICES, INC.**

**RESULTS OF ANALYSIS**

Page 1 of 2

**Client:** Angull Environmental Systems  
**Client Sample ID:** Method Blank  
**Client Project ID:** MWH/10908

**CAS Project ID:** P2301012  
**CAS Sample ID:** P030606-MB

**Test Code:** Modified EPA TO-15  
**Instrument ID:** HP5972/Tekmar AUTOCAN Elite  
**Analyst:** Michelle Sakamoto  
**Sampling Media:** Summa Canister  
**Test Notes:**

**Date Collected:** NA  
**Date Received:** NA  
**Date(s) Analyzed:** 6/6/03  
**Volume(s) Analyzed:** 1.00 Liter(s)

D.F. = 1.00

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
74-87-3	Chloromethane	ND	1.0	ND	0.48	
75-01-4	Vinyl Chloride	ND	1.0	ND	0.39	
74-83-9	Bromomethane	ND	1.0	ND	0.26	
75-00-3	Chloroethane	ND	1.0	ND	0.38	
67-64-1	Acetone	ND	5.0	ND	2.1	
75-69-4	Trichlorofluoromethane	ND	1.0	ND	0.18	
75-35-4	1,1-Dichloroethene	ND	1.0	ND	0.25	
75-09-2	Methylene chloride	ND	1.0	ND	0.29	
76-13-1	Trichlorotrifluoroethane	ND	1.0	ND	0.13	
75-15-0	Carbon Disulfide	ND	1.0	ND	0.32	
156-60-5	trans-1,2-Dichloroethene	ND	1.0	ND	0.25	
75-34-3	1,1-Dichloroethane	ND	1.0	ND	0.25	
1634-04-4	Methyl tert-Butyl Ether	ND	1.0	ND	0.28	
108-05-4	Vinyl Acetate	ND	1.0	ND	0.28	
78-93-3	2-Butanone (MEK)	ND	1.0	ND	0.34	
156-59-2	cis-1,2-Dichloroethene	ND	1.0	ND	0.25	
67-66-3	Chloroform	ND	1.0	ND	0.20	
107-06-2	1,2-Dichloroethane	ND	1.0	ND	0.25	
71-55-6	1,1,1-Trichloroethane	ND	1.0	ND	0.18	
71-43-2	Benzene	ND	1.0	ND	0.31	
56-23-5	Carbon Tetrachloride	ND	1.0	ND	0.16	
78-87-5	1,2-Dichloropropane	ND	1.0	ND	0.22	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By:                     PME                     Date:                     06/10/03



**Columbia Analytical Services, Inc.  
Sample Acceptance Check Form**

Client: Anguil Environmental Systems

Work order: P2301012

Project: MWH/10908

Sample(s) received on: 5/28/03 Date opened: 5/28/03 by RD

*Note:* This form is used for all samples received by CAS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client or as required by the method/SOP.

		<b>Yes</b>	<b>No</b>	<b>N/A</b>
1	Were custody seals on outside of cooler/Box?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Were custody seals on outside of sample container?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Location of seal(s)? _____ Sealing Lid?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Were signature and date included?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Were seals intact?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2	Were sample containers marked with client sample ID?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Did sample containers arrive in good condition?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	Were chain-of-custody papers used and filled out?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Did sample container labels and/or tags agree with custody papers?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Was sample volume received adequate for analysis?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Are samples within specified holding times?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Was proper temperature (thermal preservation) of cooler at receipt adhered to?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Cooler Temperature <u>NA</u> °C			
	Blank Temperature <u>NA</u> °C			
9	Is pH (acid) preservation necessary, according to method/SOP or Client specified information?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Is there a client indication that the submitted samples are pH (acid) preserved?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Were <u>VOA</u> vials checked for presence/absence of air bubbles?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

P2301012-001				NA
P2301012-002				NA

Explain any discrepancies: (include lab sample ID numbers):  
Analysis on C of C does not match scheduling form.



**Air Quality Laboratory**  
2665 Park Center Drive, Suite D  
Simi Valley, California 93065  
Phone (805) 526-7161  
Fax (805) 526-7270

**Chain of Custody Record  
Analytical Service Request**

Client/Address ANGUIL ENVIRONMENTAL SYSTEMS 8055 N. 55th ST. MILWAUKEE, WI 53223				Project Name MWH				Analysis				CAS Project No. P2301012	
Phone (414) 365-6400 Fax (414) 365-6410				Project Number 10908				EPA 25C NMOC EPA TO 15				Conder / Blank Temp _____	
Email BOB LIEN @ ANGUIL . COM				Sampling Location OXIDIZER INLET / OUTLET								Expected Turnaround Time 24 hr (48hr 3Day 4Day 5Day Standard (10 Business Days))	
Contact BOB LIEN		Sampler (Signature) <i>Robert Lien</i>		P.O. #/Billing Information 2770Z									
Client Sample ID	Date Collected	Time Collected	Lab Sample No.	Type of Sample	Container ID (Serial #)	Flow Controller (Serial #)	Sample Volume (Liters)						
MWH 10908 INLET	5-27-03	2:45 PM	-001	AIR	01373	FC00141	6	X	X				SCO0413 -4.4 ug/m <sup>3</sup>
MWH 10908 OUTLET	5-27-03	2:45 PM	-002	AIR	00085	FC00164	6	X	X				SCO0291 -8.1 ug/m <sup>3</sup>
Relinquished by: (Signature) <i>Robert Lien</i>			Date: 5/27-03	Time: 3:15 P	Received by: (Signature) <i>John D To</i>			Date: 5/28/03	Time: 11:00	Additional Comments			
Relinquished by: (Signature)			Date:	Time:	Received by: (Signature)			Date:	Time:				
Relinquished by: (Signature)			Date:	Time:	Received by: (Signature)			Date:	Time:				

JUL-01-03 04:24 PM P.16

**APPENDIX L**

**CONTROL AND INSTRUMENTATION EQUIPMENT AS-BUILT DRAWINGS**

**Montgomery Watson**

**MWH-SBPA-ISVE BLOWER**

**Expansion**

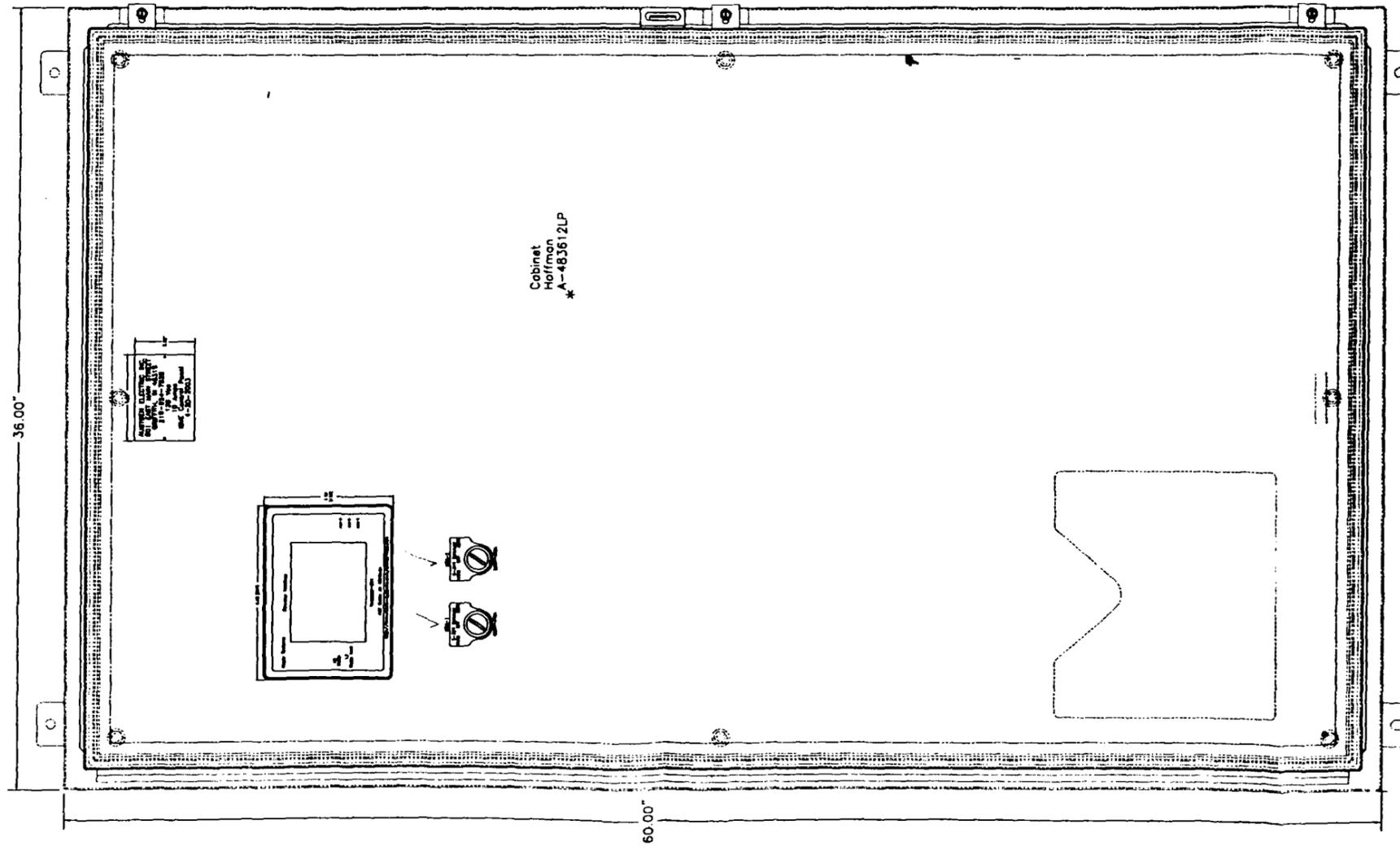
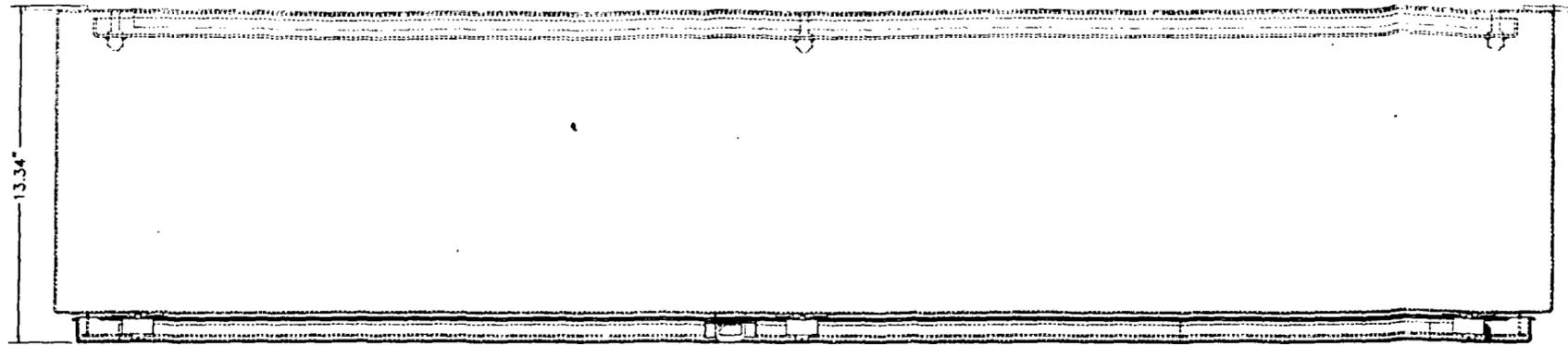
**Griffith, Indiana**

**3-26-2003**

*Austgen Electric Inc.*

*801 East Main Street*

*Griffith, IN 46319*



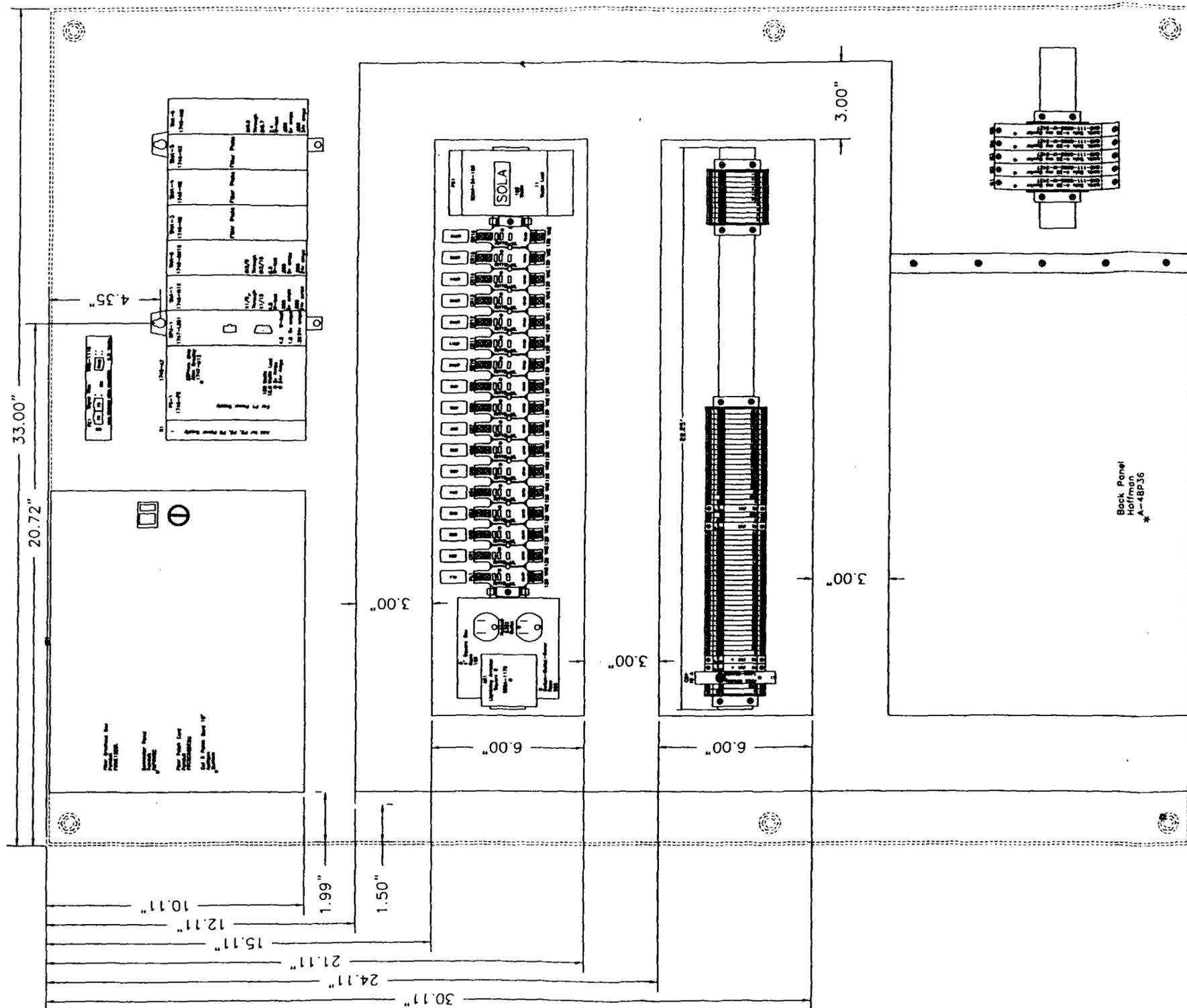
*Austgen Electric Inc.*  
 801 East Main Street  
 Griffith, IN 46319

DATE	REVISION	BY	CHKD

SBPA-ISVE-Control Panel

JOB # 11170      DATE: 3-26-03  
 FILE M:\Drawings\MWH-Blower-11170\drawings\

Customer: Montgomery Watson Harza  
 Title SBPA-ISVE Blower  
 DRAWN BY: ma      Total Sheets 12  
 Drawing No. E1.dwg



*Austgen Electric Inc.*  
 801 East Main Street  
 Griffith, IN 46319

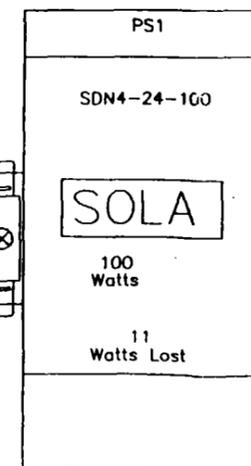
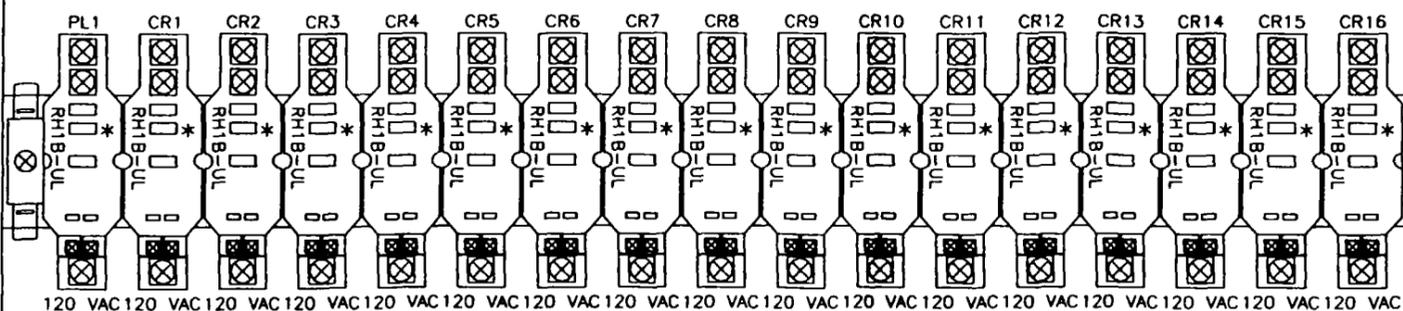
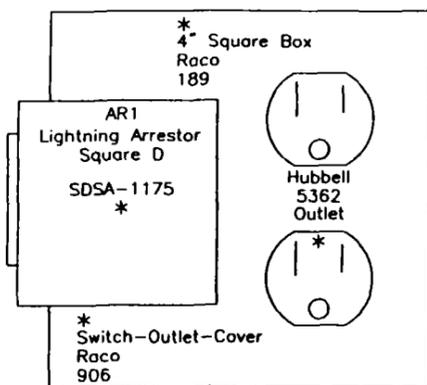
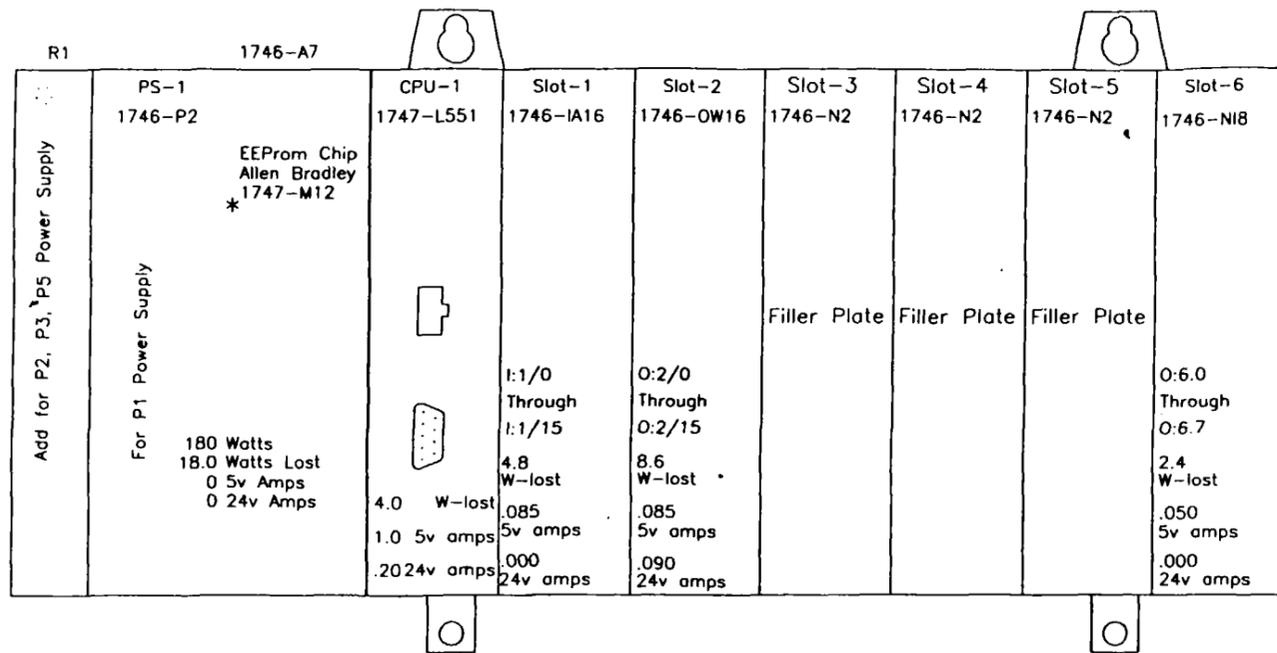
DATE	REVISION	BY	CHKD

SBPA-ISVE-Control Panel

JOB # 11170      DATE: 3-26-03

FILE M:\Projects\MWH\Blower-11170\Panel-CP1-11170\

Customer: Montgomery Watson Harza  
 Title SBPA-ISVE Blower  
 DRAWN BY: ma      Total Sheets 12  
 Drawing No. E2.dwg



*Austgen Electric Inc.*  
801 East Main Street  
Griffith, IN 46319

DATE	REVISION	BY	DRB

SBPA-ISVE-Control Panel

JOB # 11170      DATE: 3-26-03

FILE M:\Projects\MWH\Blower-11170\Panel-CP1-11170\

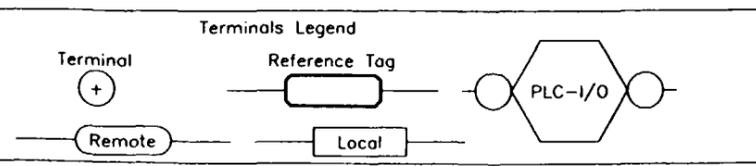
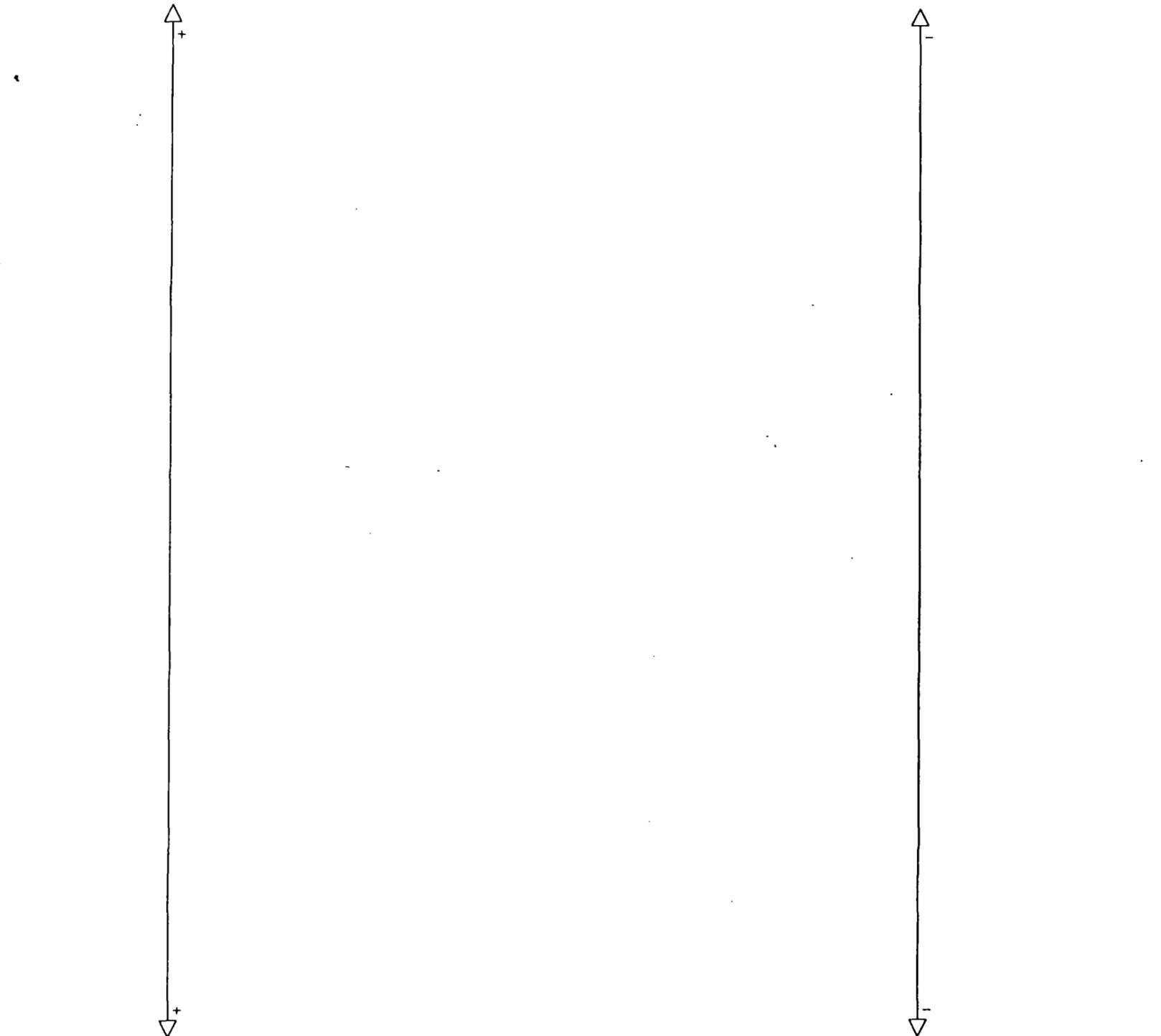
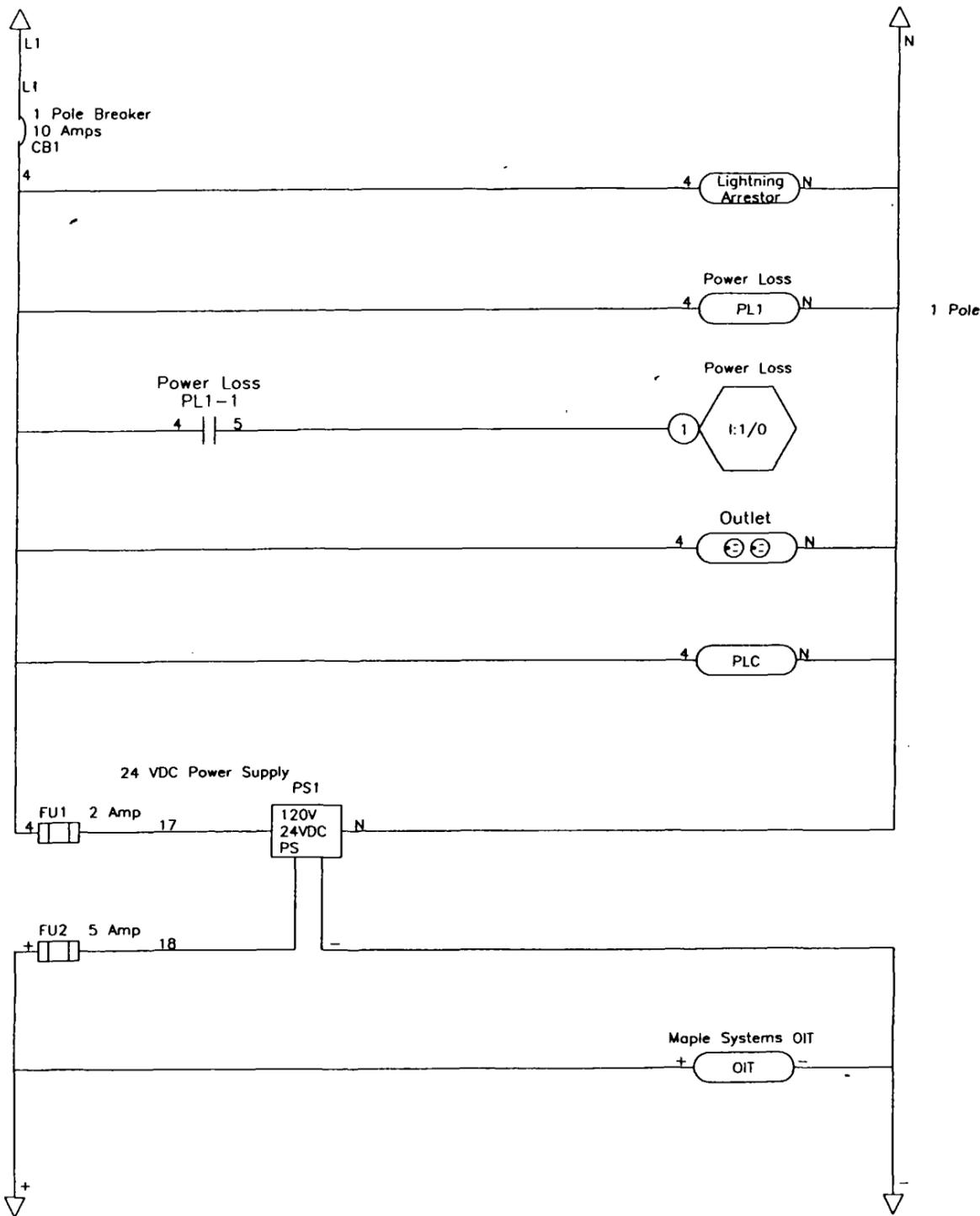
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Title SBPA-ISVE Blower

DRAWN BY: mo      Total Sheets 12

Drawing No. E3.dwg



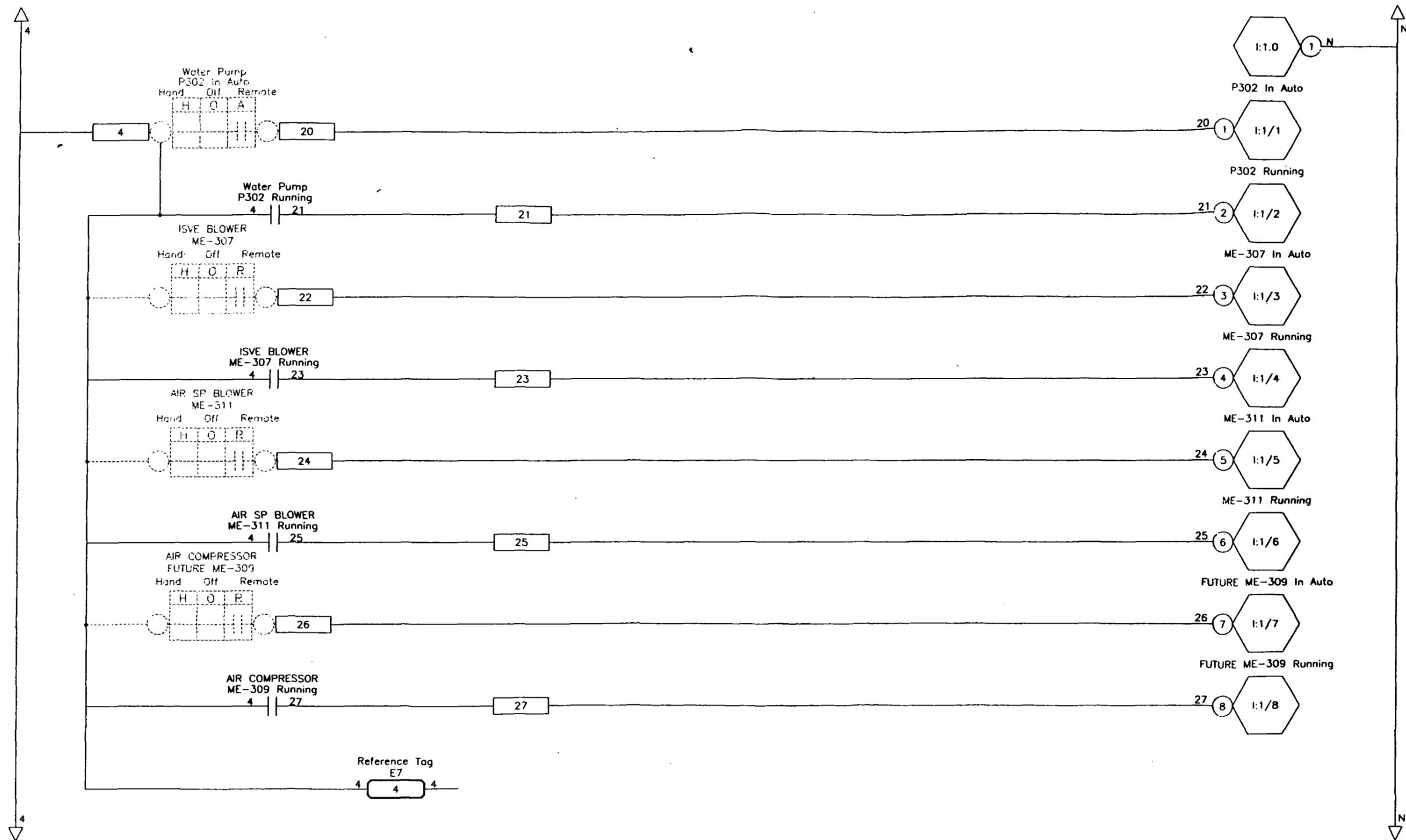


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 Griffith, IN 46319

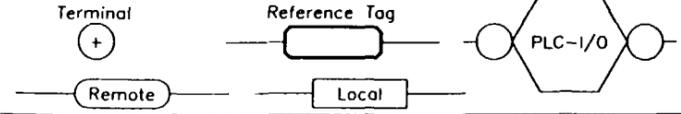
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SBPA-ISVE-Control Panel  
 JOB # 11170 DATE: 3-26-03  
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Customer: Montgomery Watson Harza  
 Title SBPA-ISVE Blower  
 DRAWN BY: ma Total Sheets 12  
 Drawing No. E5.dwg



Terminals Legend

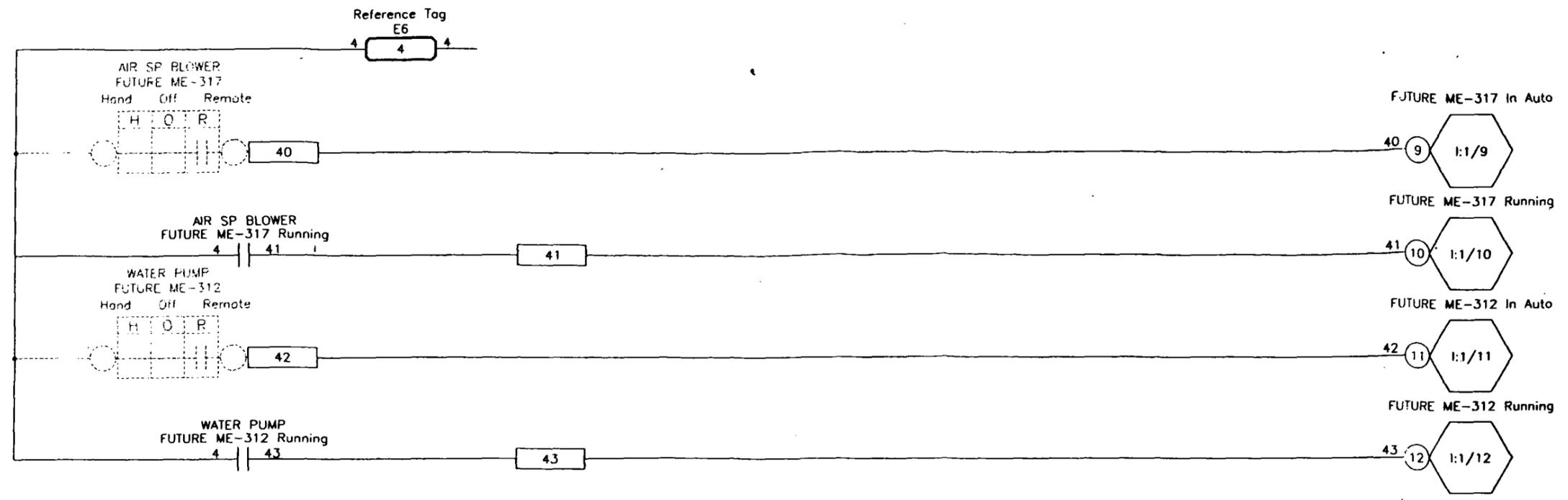


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Griffith, IN 46319

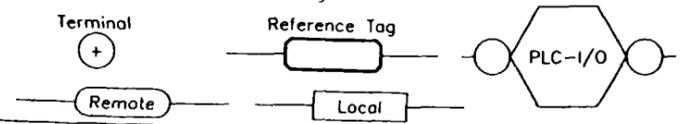
DATE	REVISION	BY	CHKD

SBPA-ISVE-Control Panel  
JOB # 11170 DATE: 3-26-03  
FILE M:\Projects\MWH\Blower-11170\Panel-CP1-11170\

Customer: Montgomery Watson Harza  
Title SBPA-ISVE Blower  
DRAWN BY: me Total Sheets 12  
Drawing No. E6.dwg



Terminals Legend



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Griffith, IN 46319

DATE	REVISION	BY	CHKD

SBPA-ISVE-Control Panel

JOB # 11170      DATE: 3-26-03

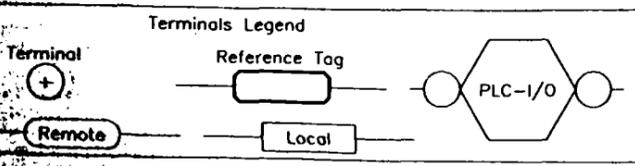
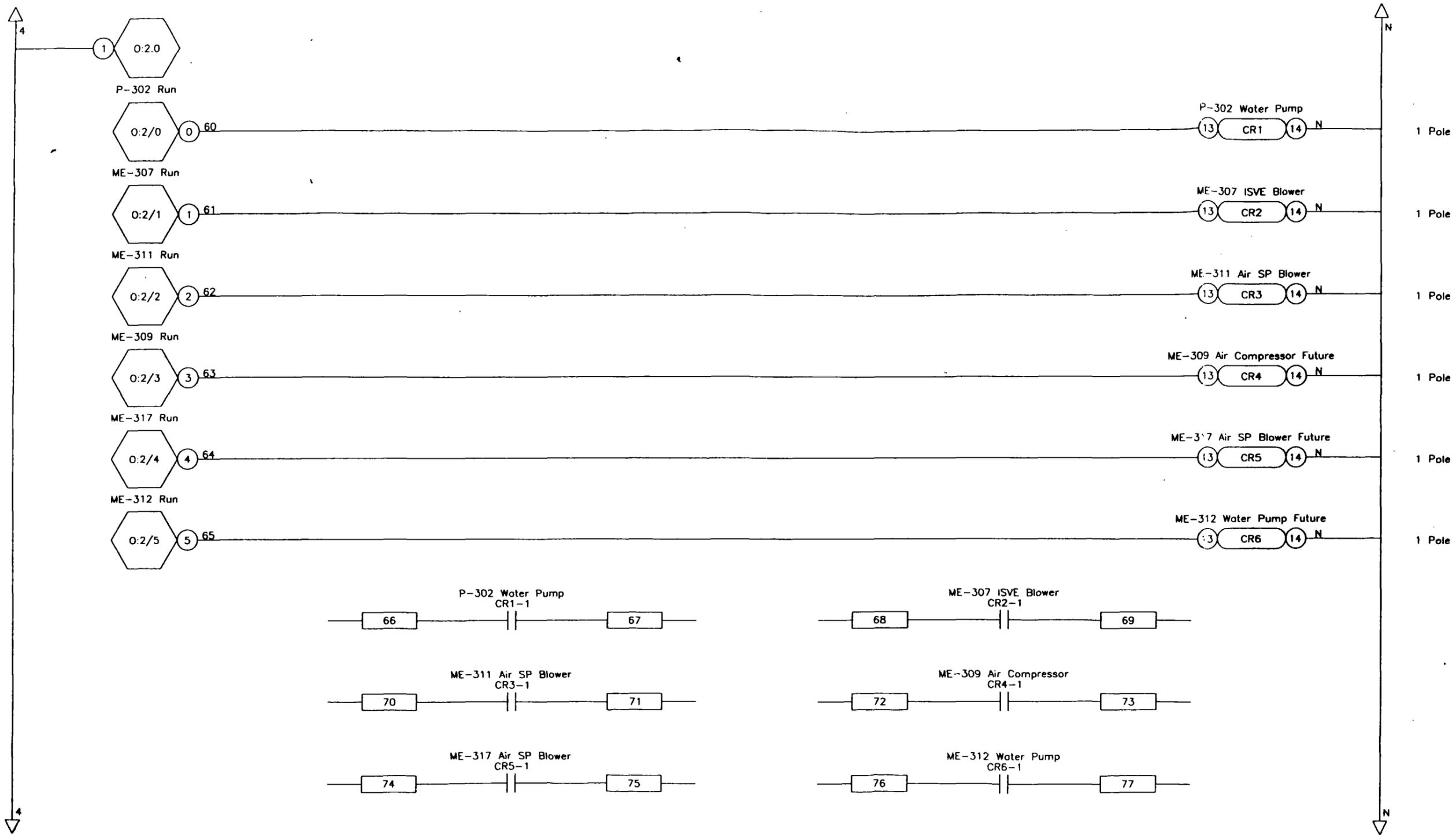
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Customer: Montgomery Watson Harza

Title SBPA-ISVE Blower

DRAWN BY: mo      Total Sheets 12

Drawing No. E7.dwg



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 801 East Main Street  
 Griffith, IN 46319

DATE	REVISION	BY	CHKD

SBPA-ISVE-Control Panel

JOB # 11170      DATE: 3-26-03

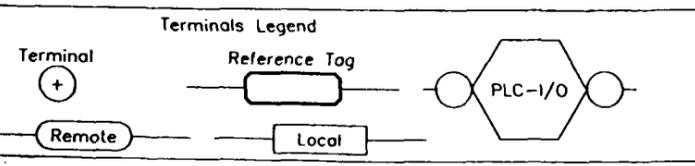
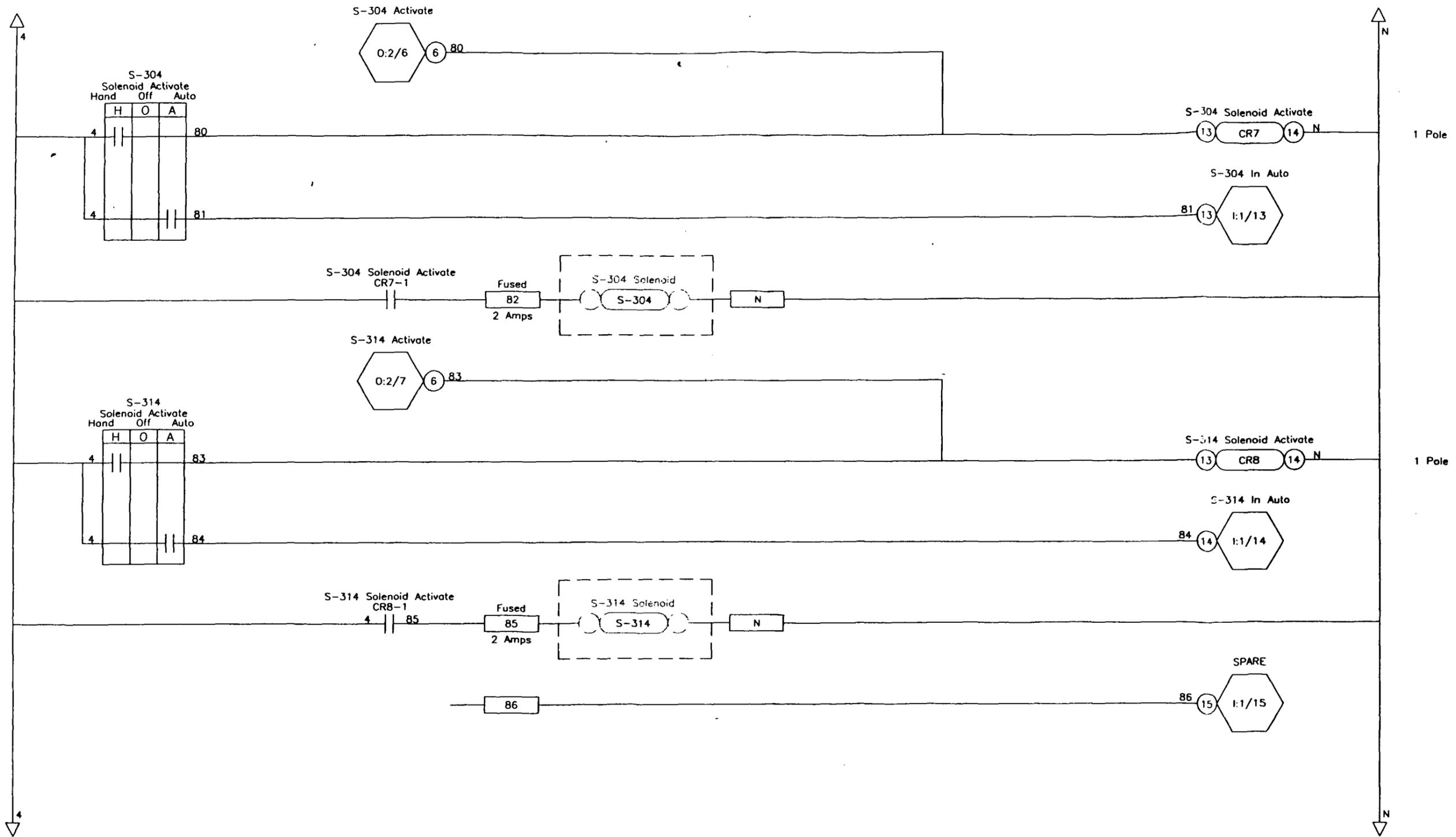
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Customer: Montgomery Watson Harza

Title SBPA-ISVE Blower

DRAWN BY: mo      Total Sheets 12

Drawing No. E8.dwg



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 Griffith, IN 46319

DATE	REVISION	BY	CHKD

SBPA-ISVE-Control Panel

JOB # 11170      DATE: 3-26-03

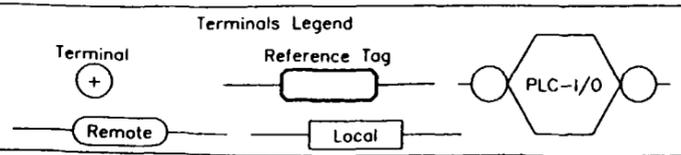
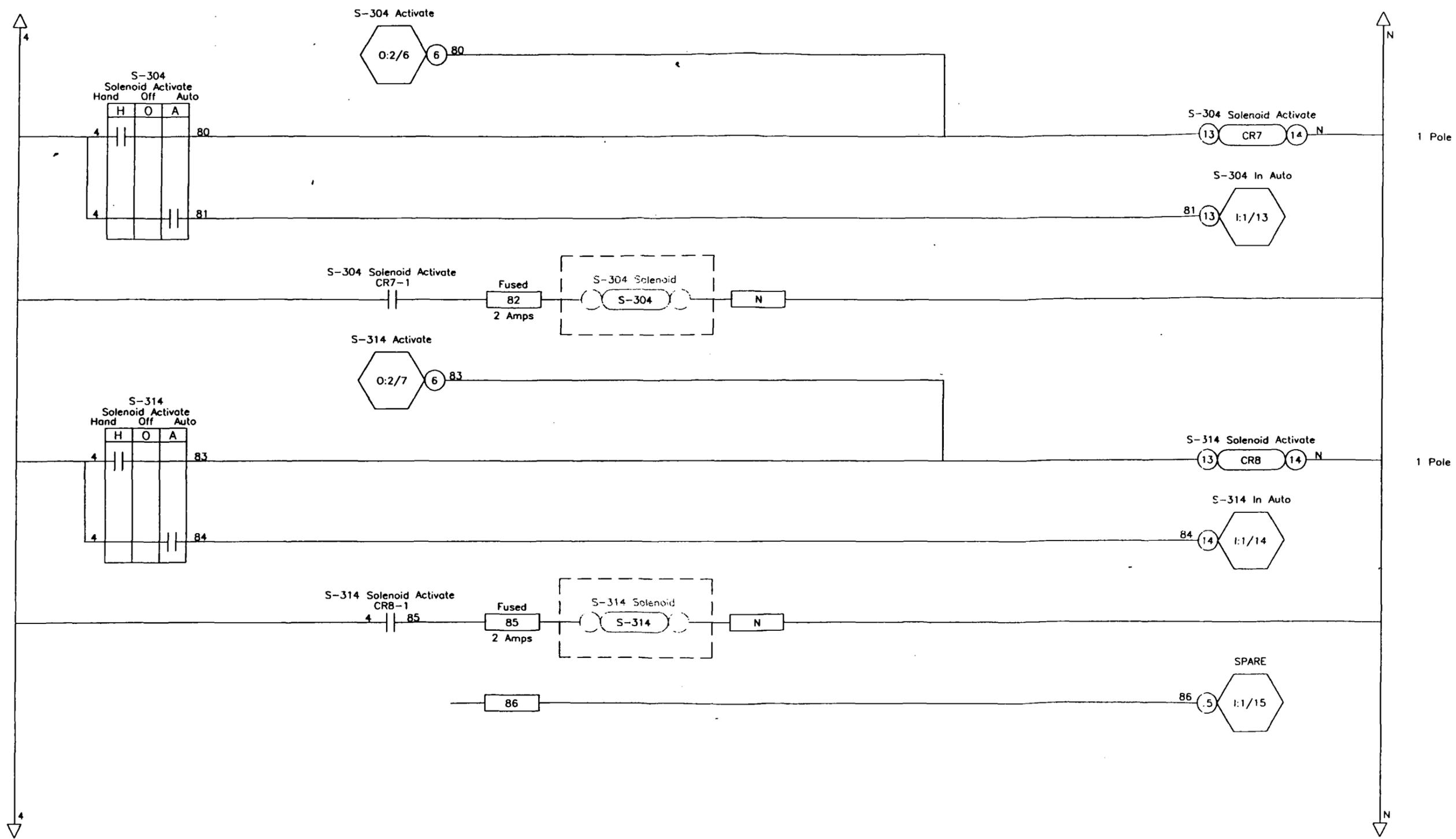
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Customer: Montgomery Watson Harza

Title SBPA-ISVE Blower

DRAWN BY: ma      Total Sheets 12

Drawing No. E9.dwg



**Austgen Electric Inc.**  
 801 East Main Street  
 Griffith, IN 46319

DATE	REVISION	BY	CRD

SBPA-ISVE-Control Panel

JOB # 11170      DATE: 3-26-03

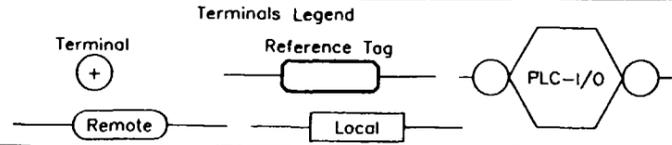
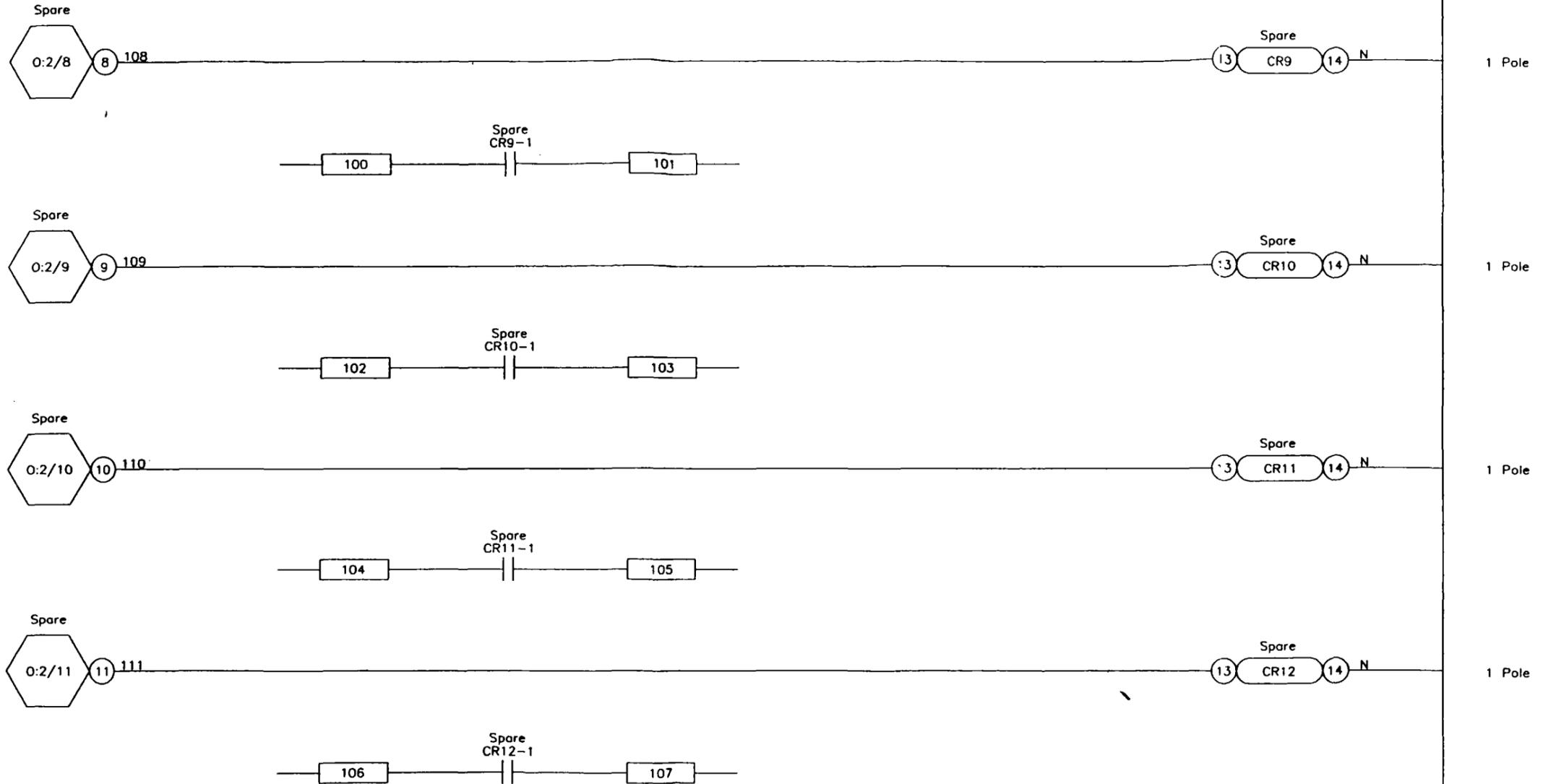
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Customer: Montgomery Watson Harza

Title SBPA-ISVE Blower

DRAWN BY: ma      Total Sheets 12

Drawing No. E9.dwg



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 Griffith, IN 46319

DATE	REVISION	BY	CHKD

SBPA-ISVE-Control Panel

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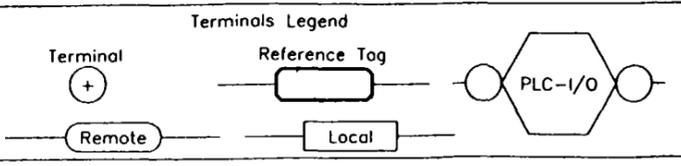
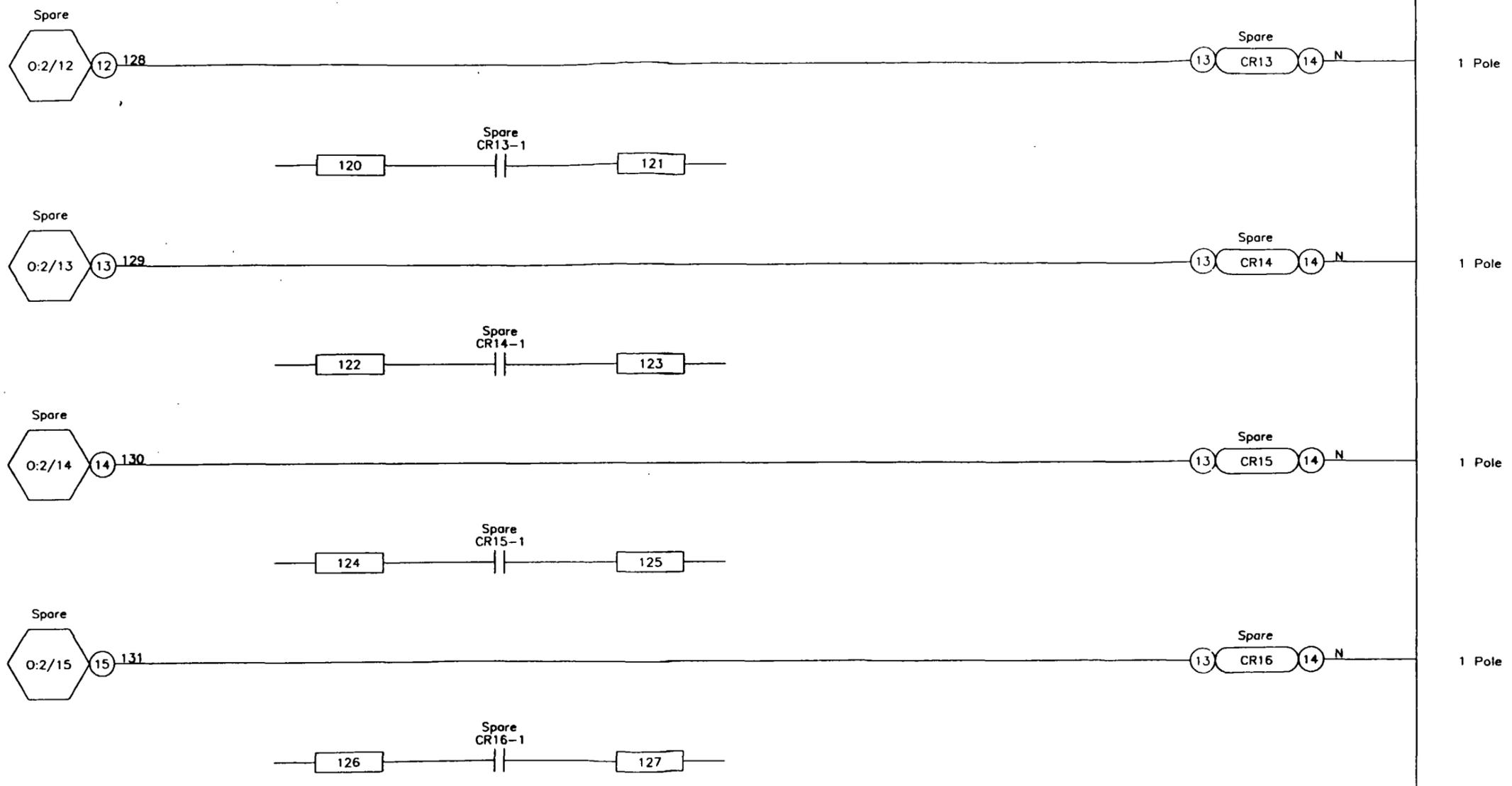
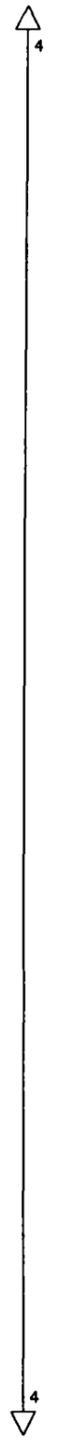
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Customer: Montgomery Watson Harza

Title SBPA-ISVE Blower

DRAWN BY: ma      Total Sheets 12

Drawing No. E10.dwg



*Austgen Electric Inc.*  
 801 East Main Street  
 Griffith, IN 46319

DATE	REVISION	BY	CHK'D

SBPA-ISVE-Control Panel

JOB # 11170      DATE: 3-26-03

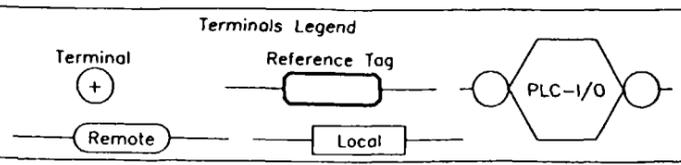
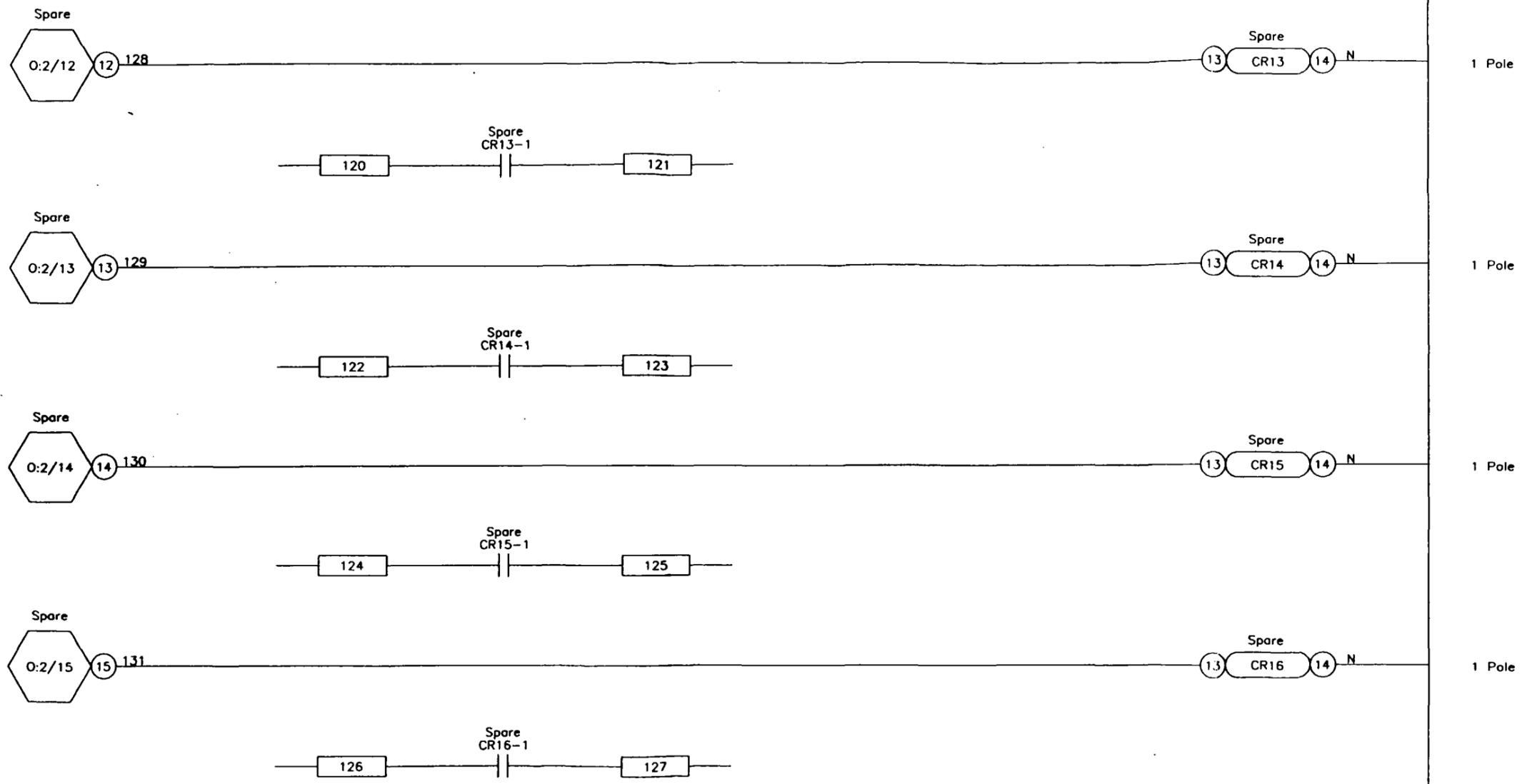
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Customer: Montgomery Watson Harza

Title SBPA-ISVE Blower

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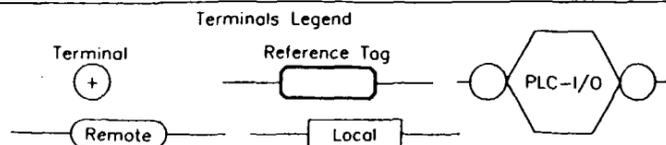
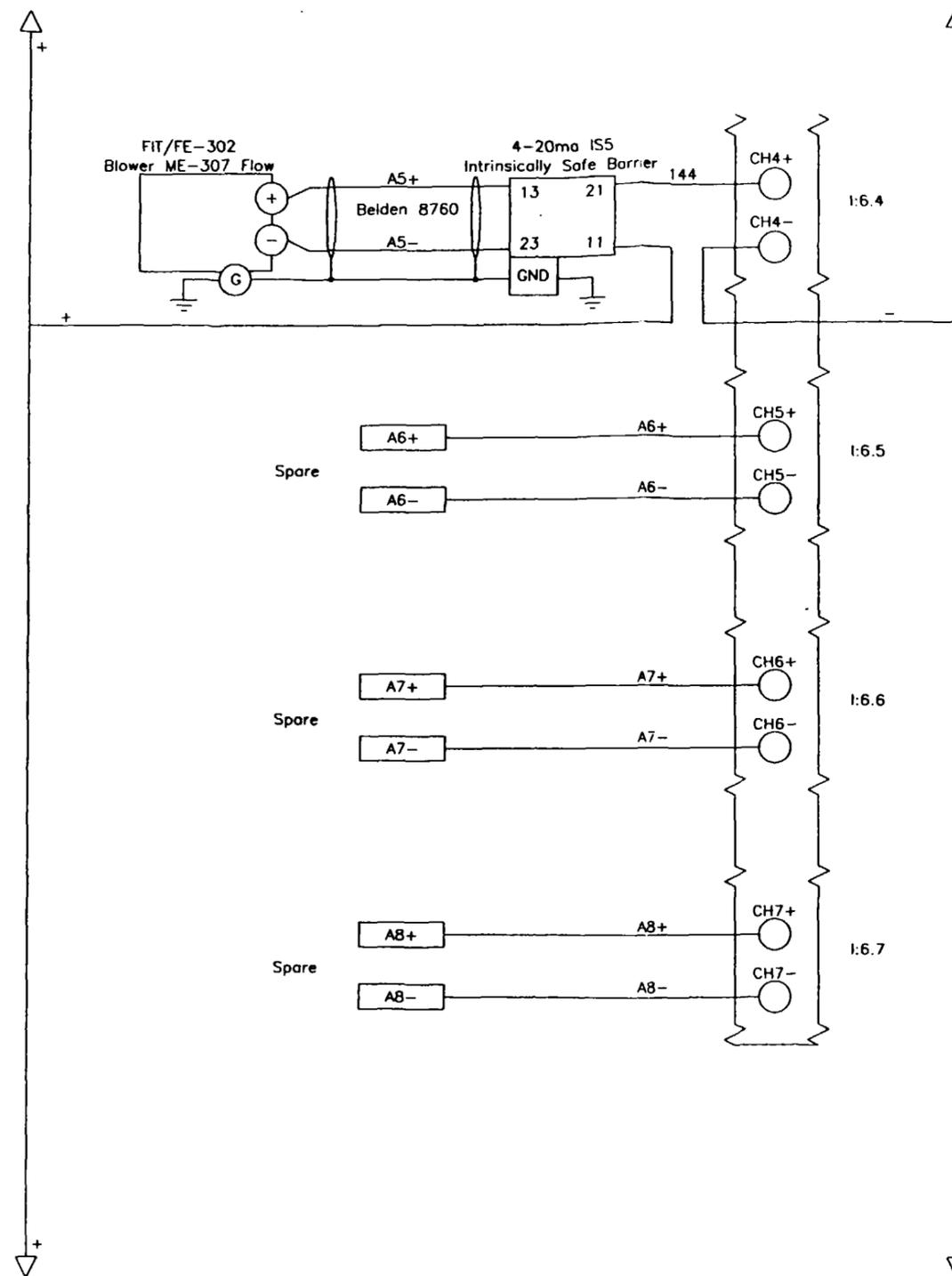
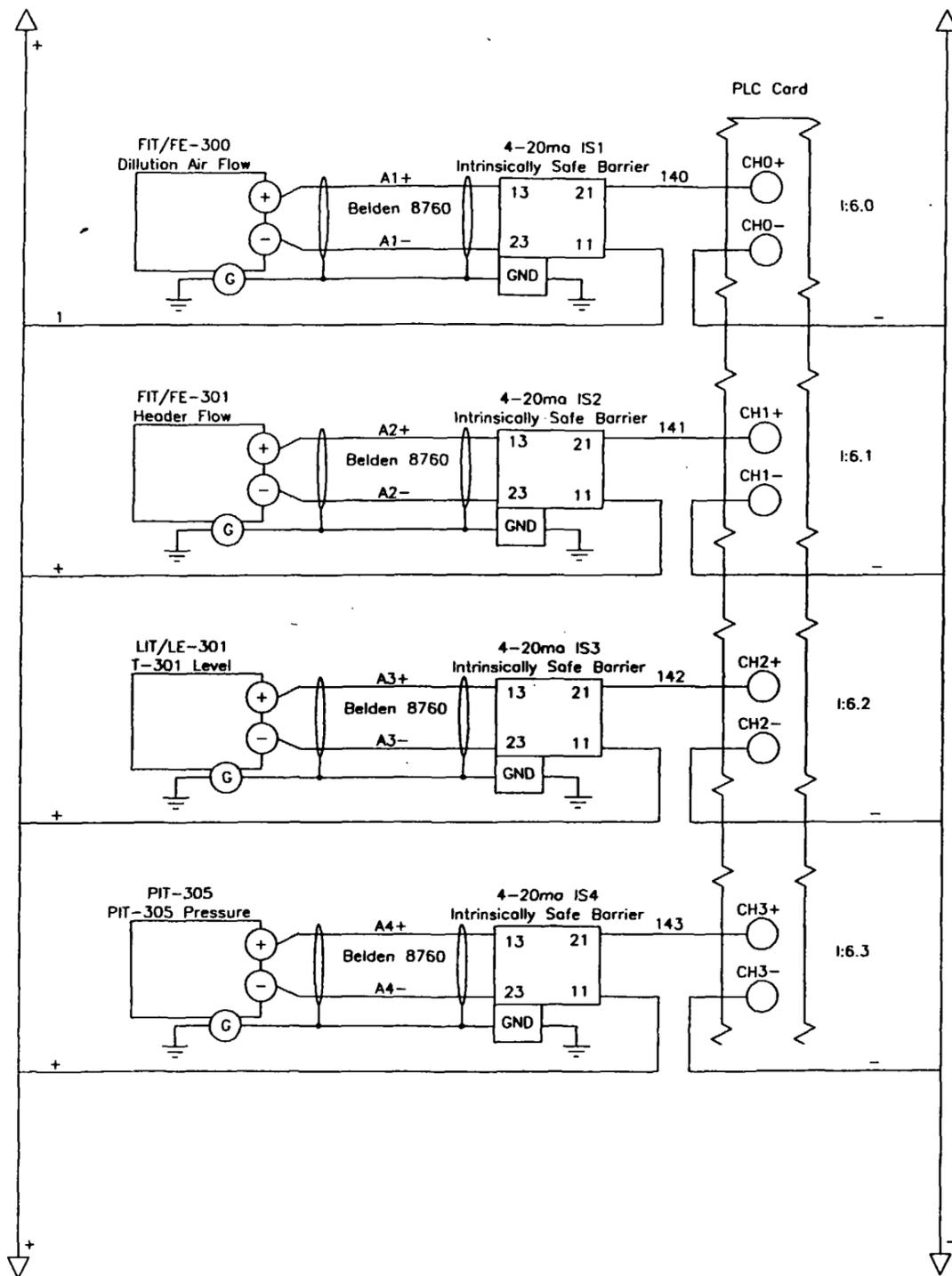
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**Austgen Electric Inc.**  
 801 East Main Street  
 Griffith, IN 46319

DATE	REVISION	BY	CHKD

SBPA-ISVE-Control Panel		Customer: Montgomery Watson Harza
JOB # 11170		Title SBPA-ISVE Blower
DATE: 3-26-03		DRAWN BY: ma Total Sheets 12
		Drawing No. E11.dwg
FILE M:\Projects\MWH\Blower-11170\Panel-CP1-11170\		



**Austgen Electric Inc.**  
 801 East Main Street  
 Griffith, IN 46319

DATE	REVISION	BY	CHKD

SBPA-ISVE-Control Panel

JOB # 11170      DATE: 3-26-03

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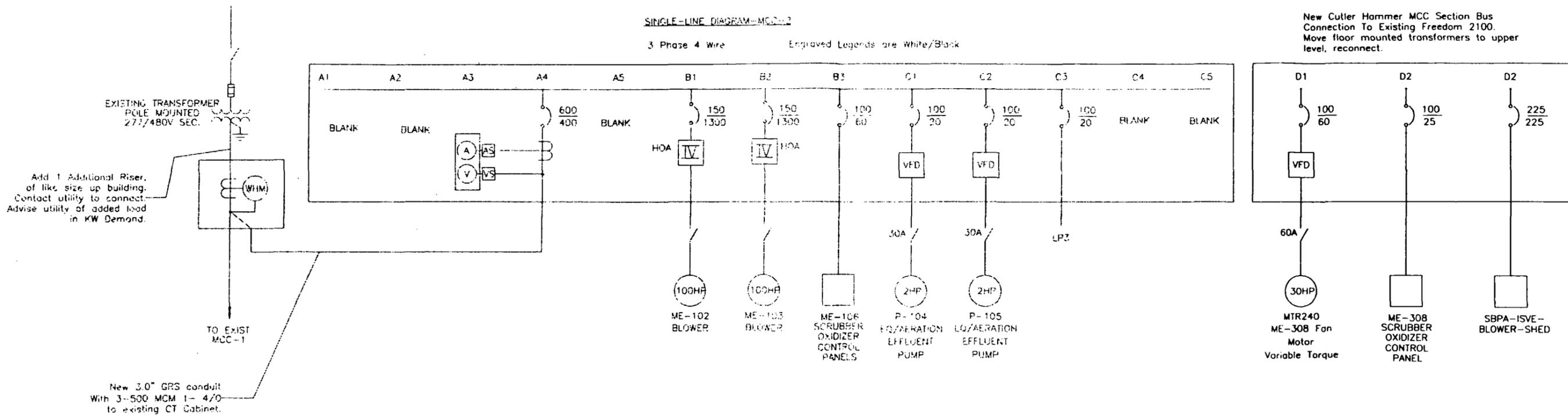
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 Title SBPA-ISVE Blower  
 DRAWN BY: mo      Total Sheets 12  
 Drawing No. E12.dwg

SINGLE-LINE DIAGRAM-MCC-2

3 Phase 4 Wire

Engraved Legends are White/Black

New Cutler Hammer MCC Section Bus  
 Connection To Existing Freedom 2100.  
 Move floor mounted transformers to upper  
 level, reconnect.



Add 1 Additional Riser,  
 of like size up building.  
 Contact utility to connect.  
 Advise utility of added load  
 in KW Demand.

TO EXIST  
 MCC-1

New 3.0" GRS conduit  
 With 3-500 MCM 1-4/0  
 to existing CT Cabinet.

- MAIN RMR
- FUTURE BLOWER
- HEATING SYSTEM
- C-302 WATER PUMP
- MAIN
- VENT FAN
- ME-102 BLOWER
- ME-103 AIR JAMMER
- FUTURE AIR COMP.
- BLOWER 201 (VENT FAN)

- LTG PANEL
- TRANSFORMER MAIN
- PANELBOARD MAIN

**Austgen Electric Inc.**  
 801 East Main Street  
 Griffith, IN 46319

DATE	REVISION	BY	CHKD

GWTP-MCC-2-Extension

JOB # 11170

DATE: 2-27-03

FILE M:\Drawings\Montgomery Watson\Blower-11170\drawings\

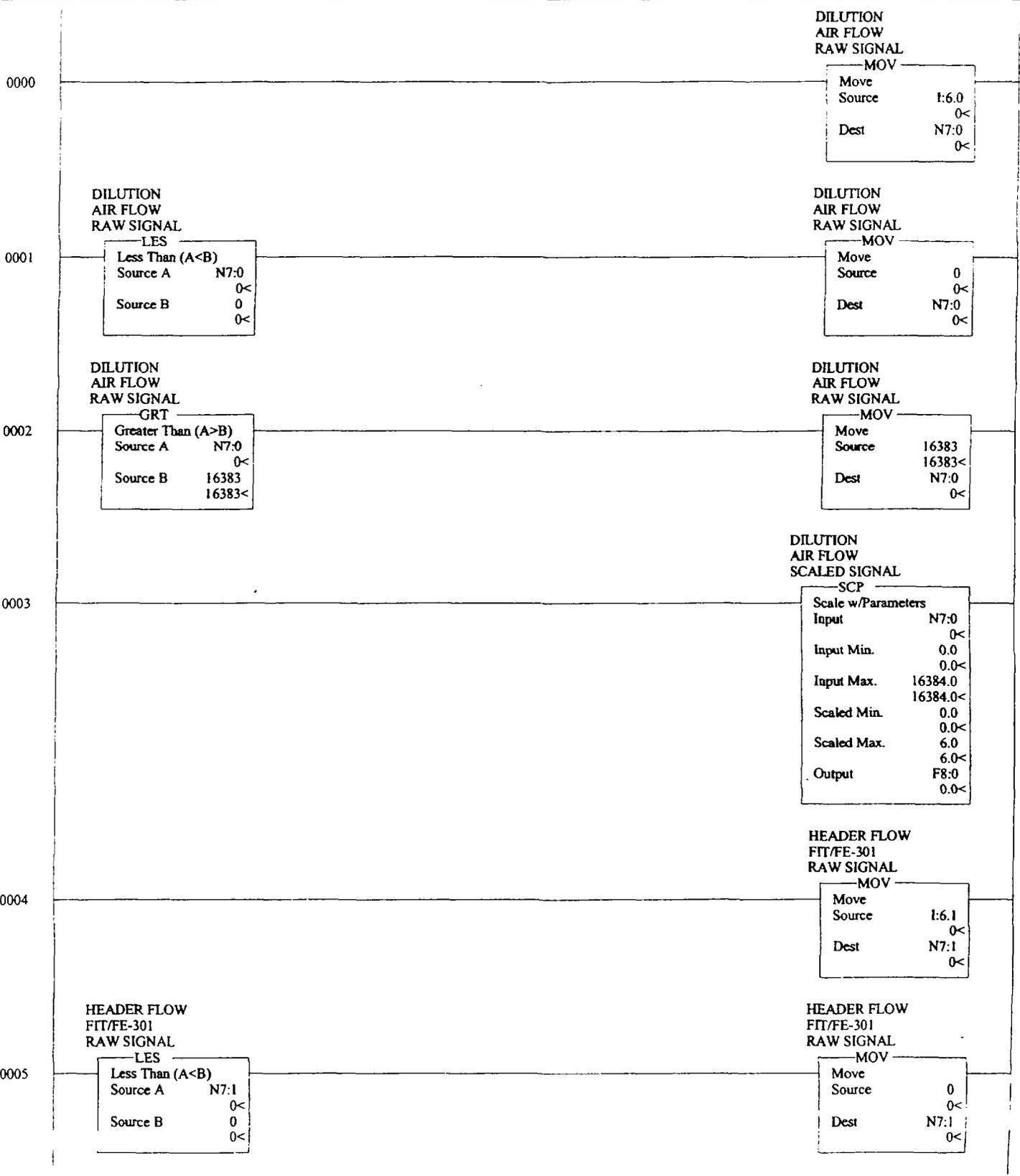
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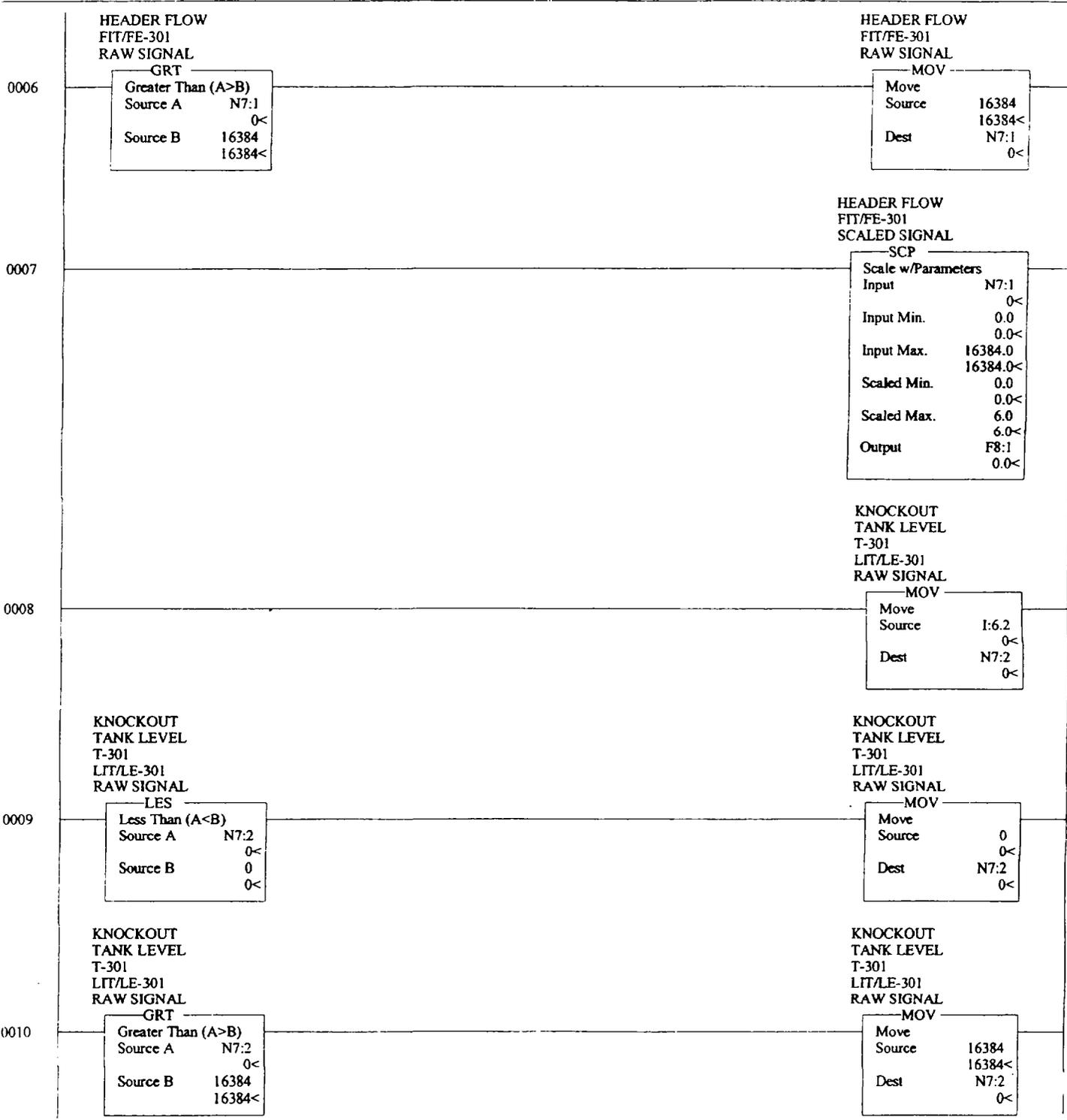
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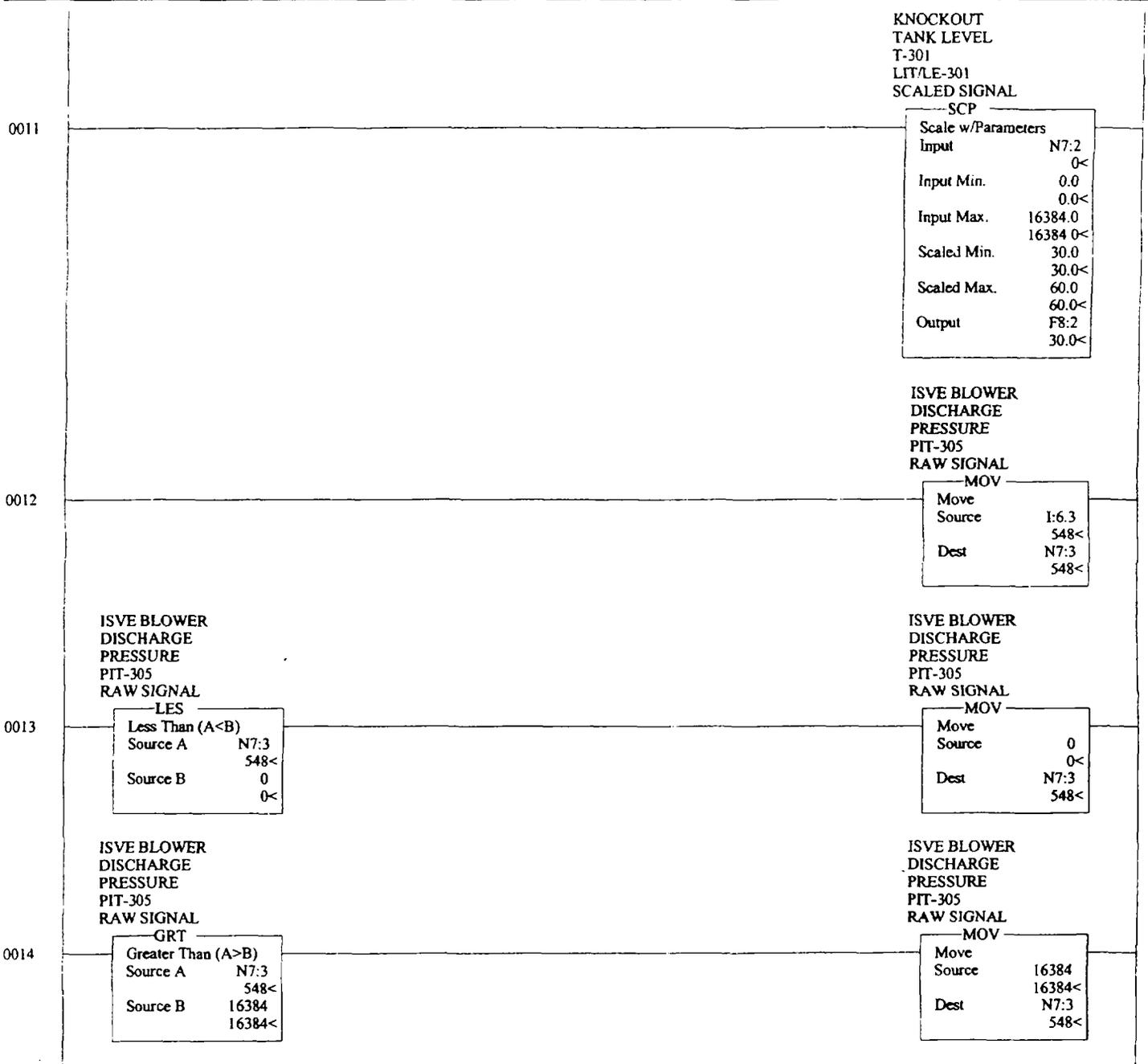
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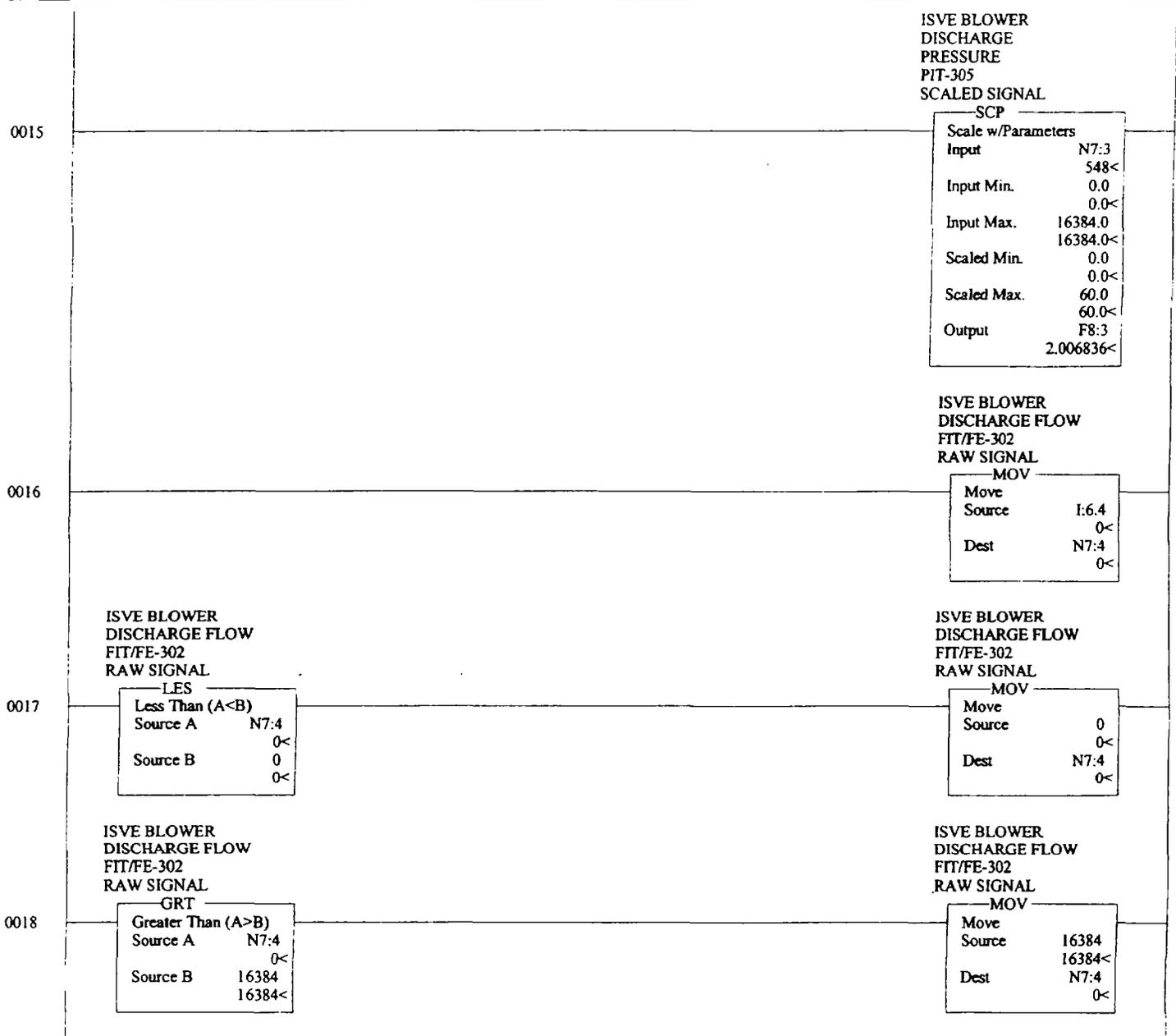


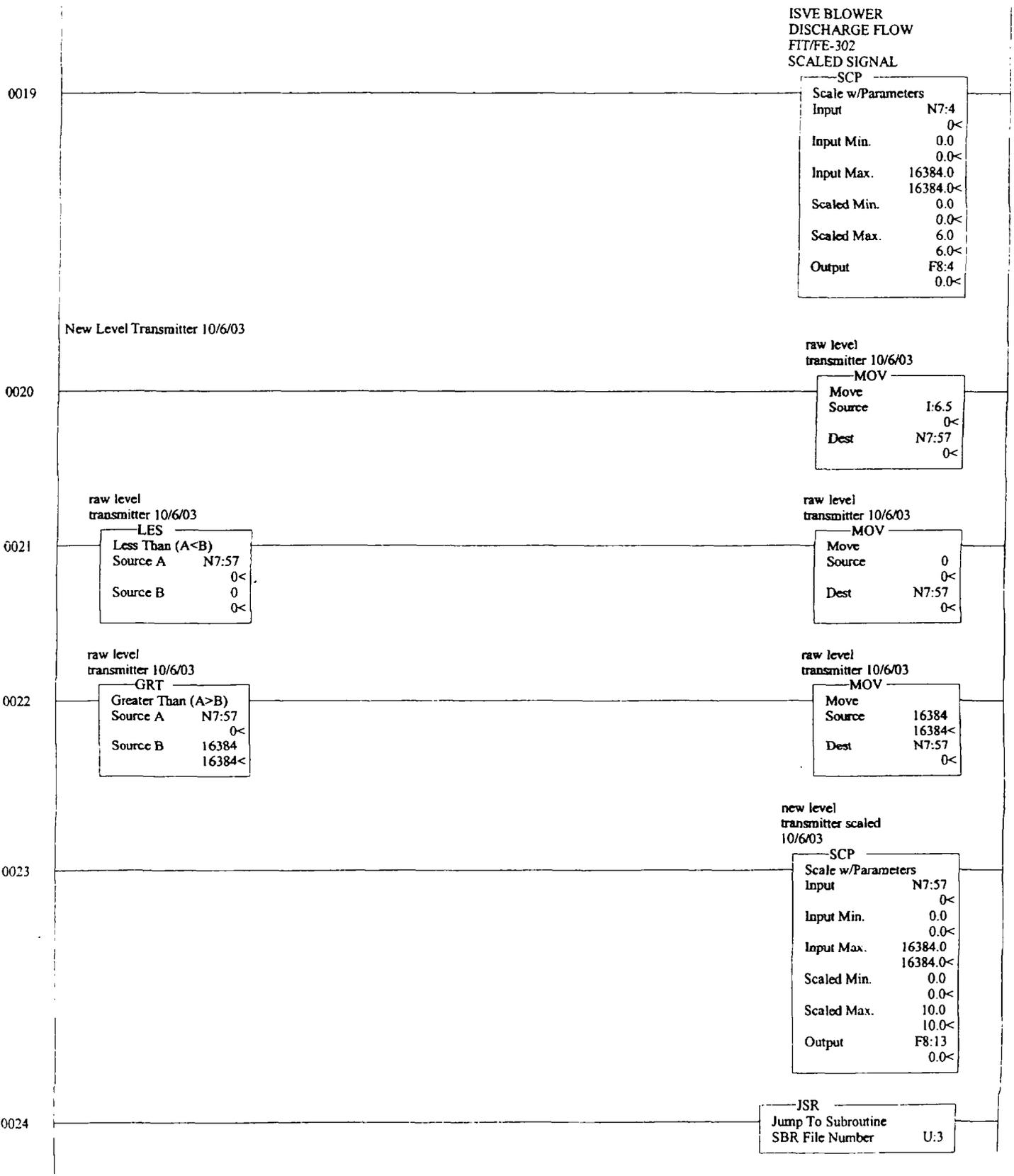


LAD 2 - ANALOG IN --- Total Rungs in File = 26



LAD 2 - ANALOG IN --- Total Rungs in File = 26





MWH On-site

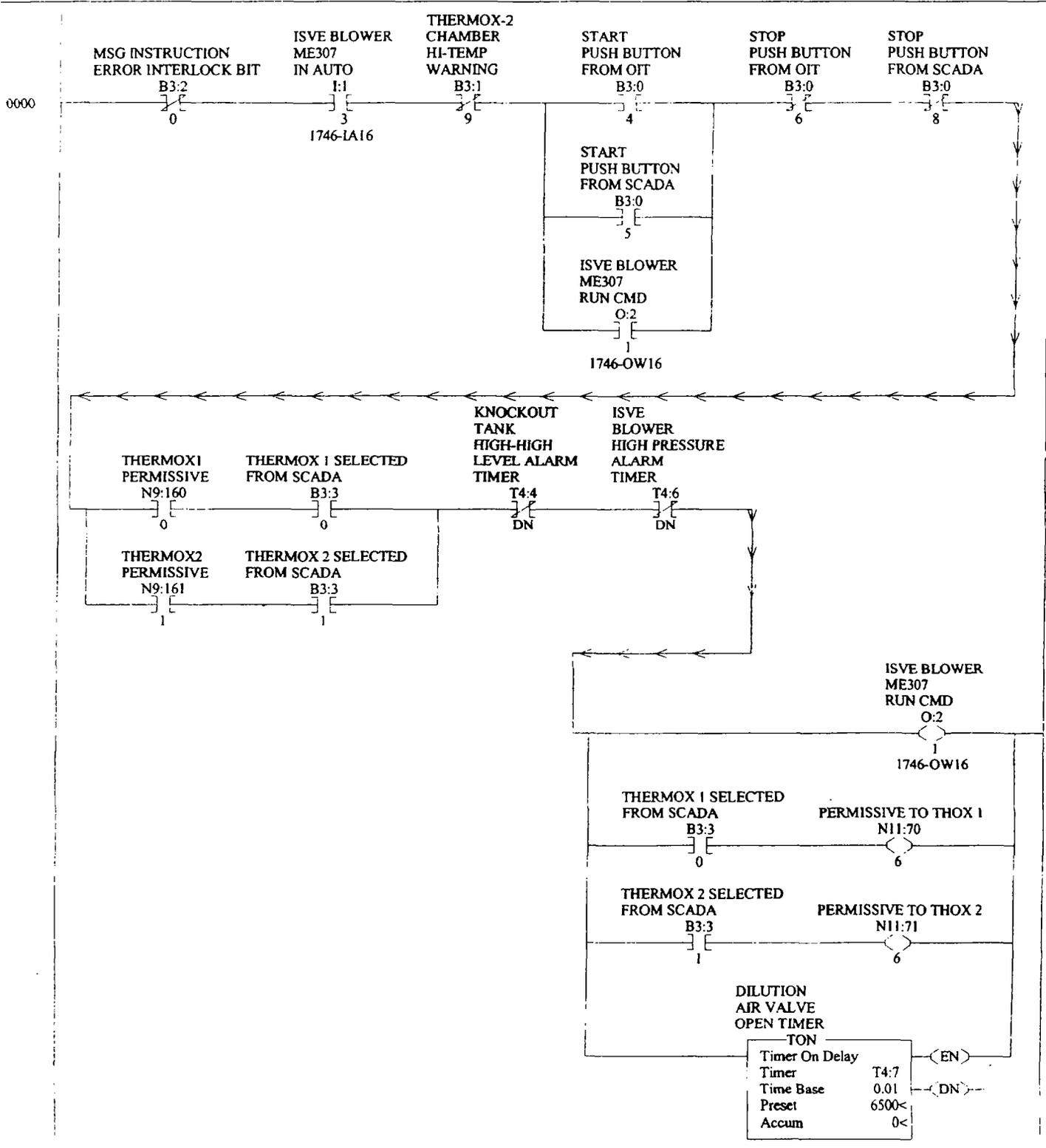
LAD 2 - ANALOG IN --- Total Rungs in File = 26

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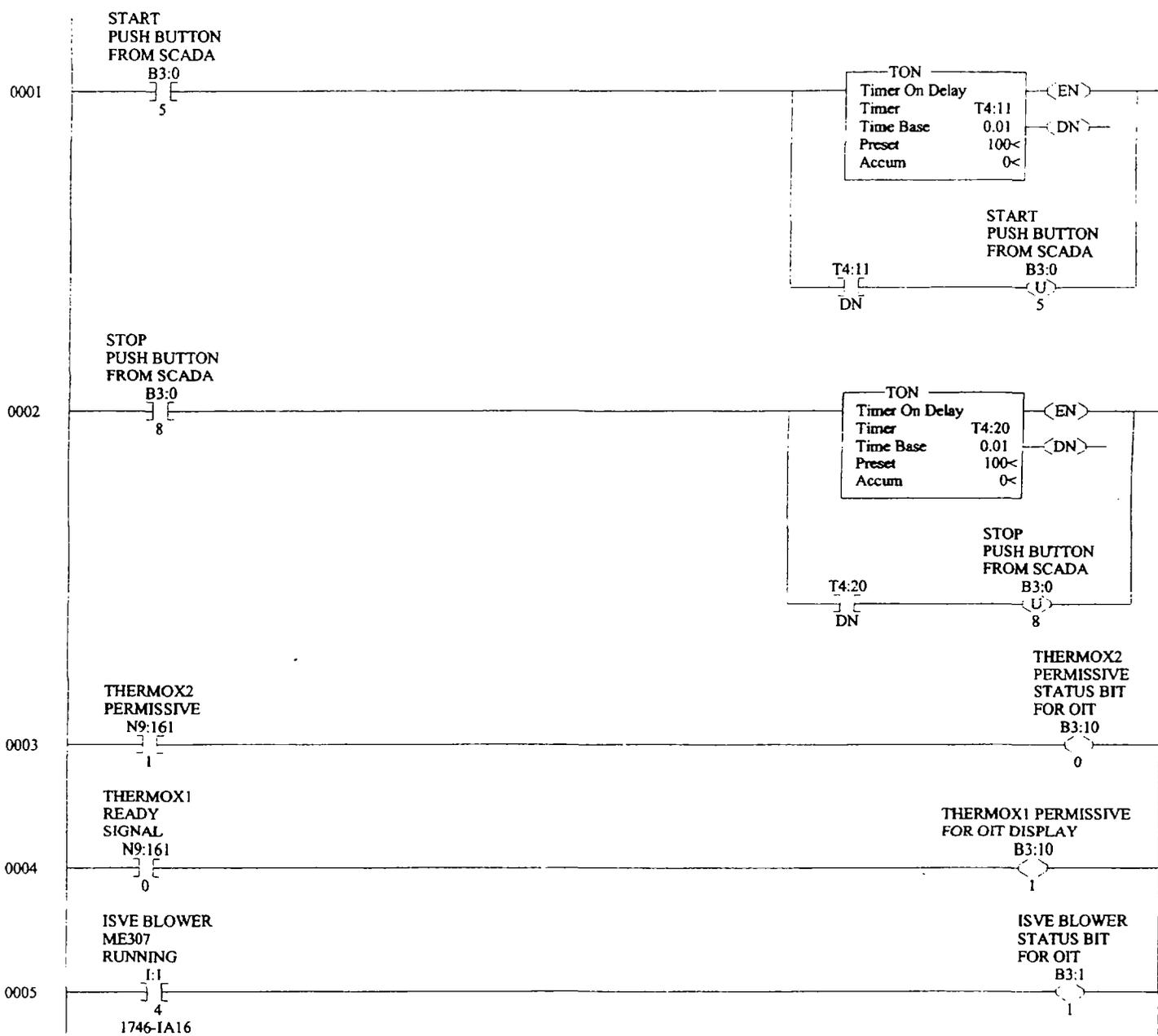
0025

END

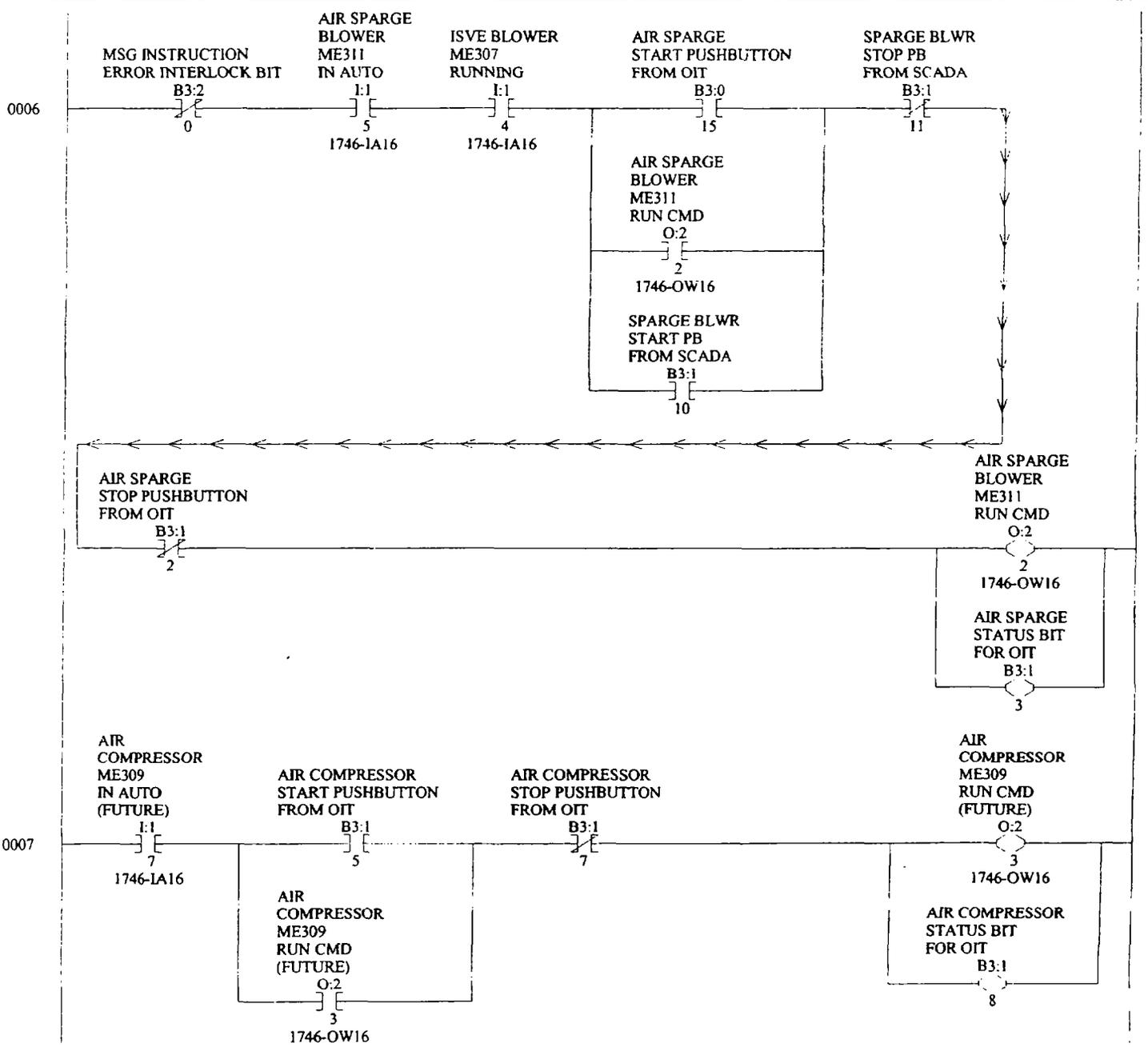
LAD 3 - CONTROLS --- Total Rungs in File = 16



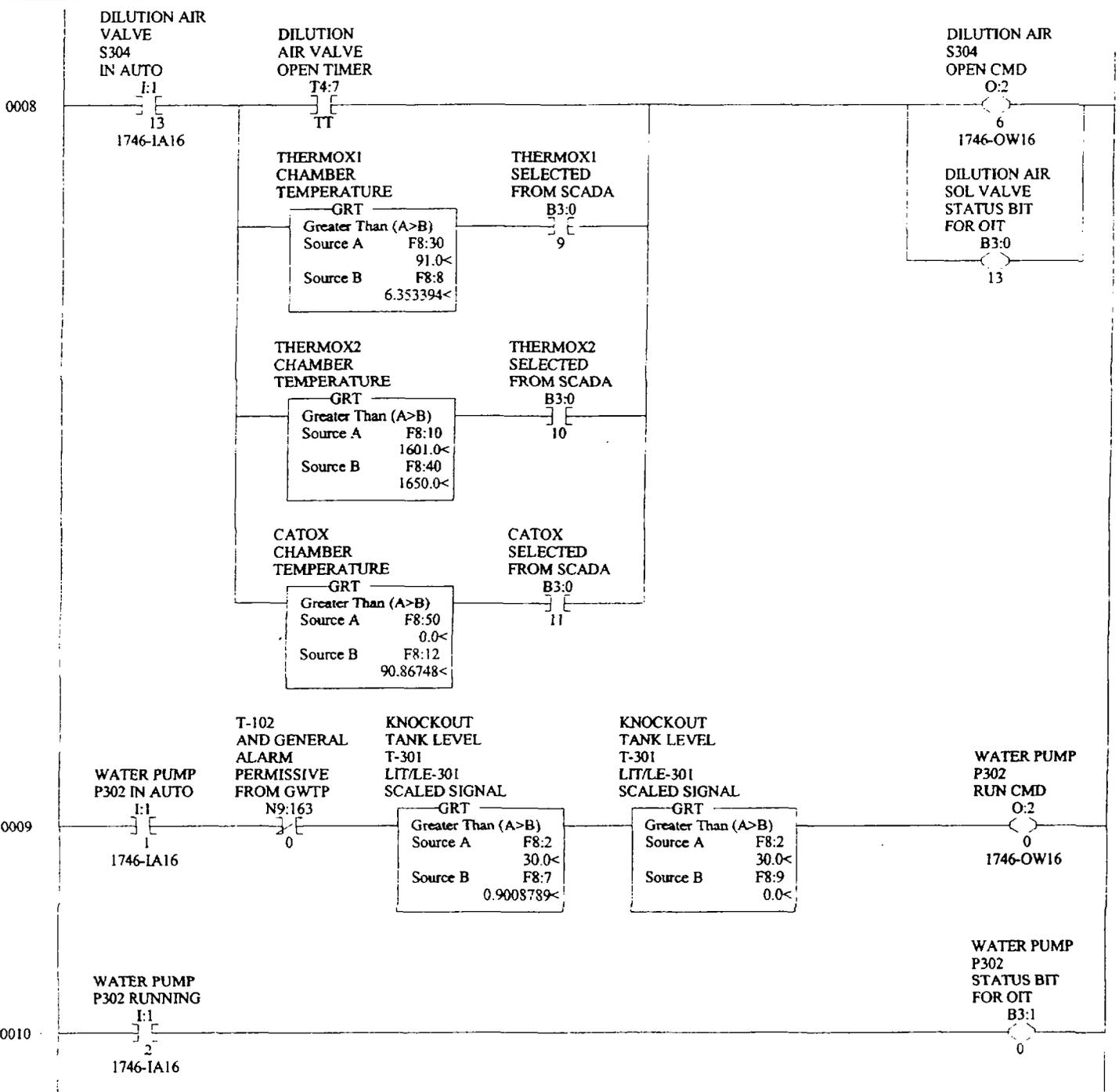
LAD 3 - CONTROLS --- Total Rungs in File = 16



LAD 3 - CONTROLS --- Total Rungs in File = 16

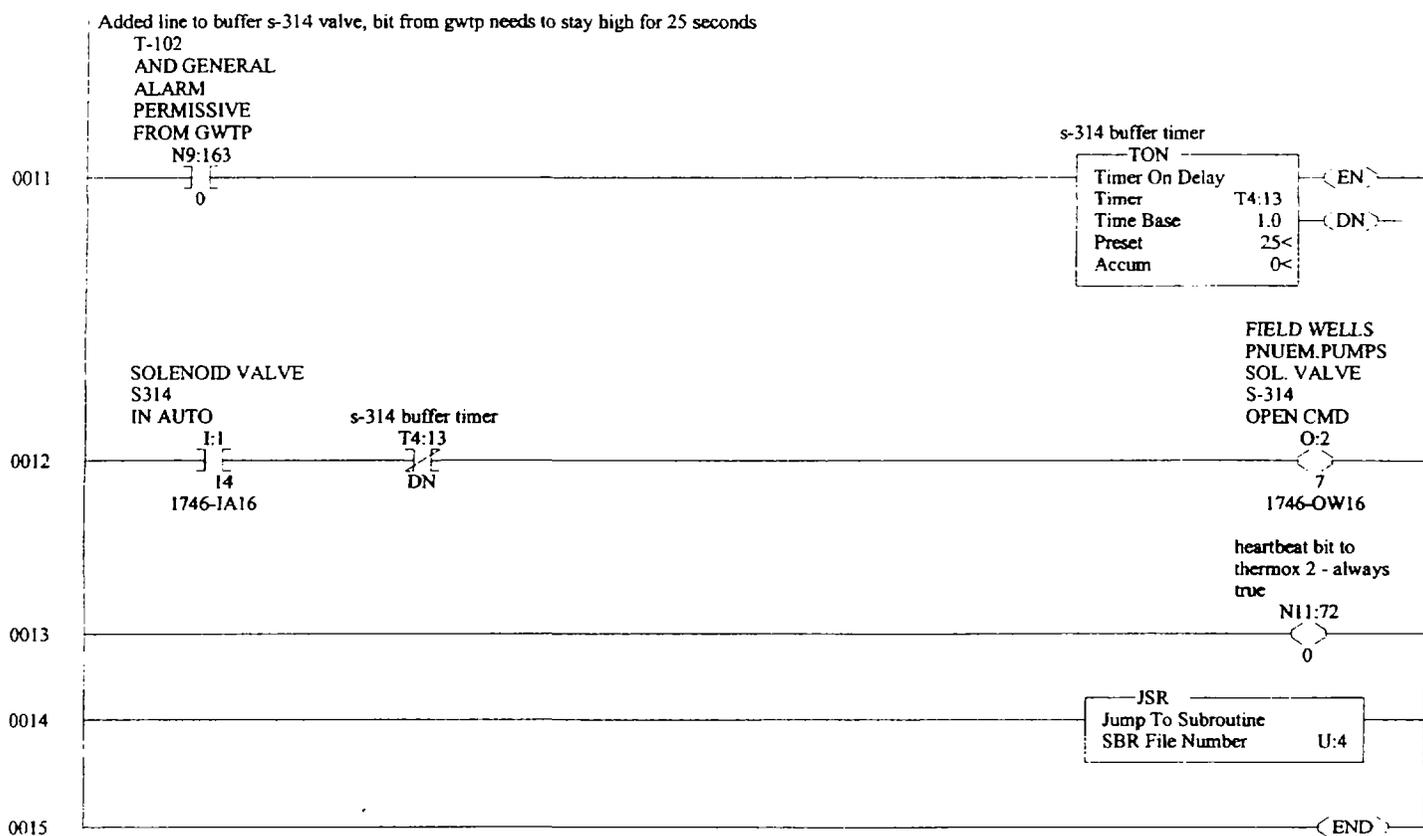


LAD 3 - CONTROLS --- Total Rungs in File = 16

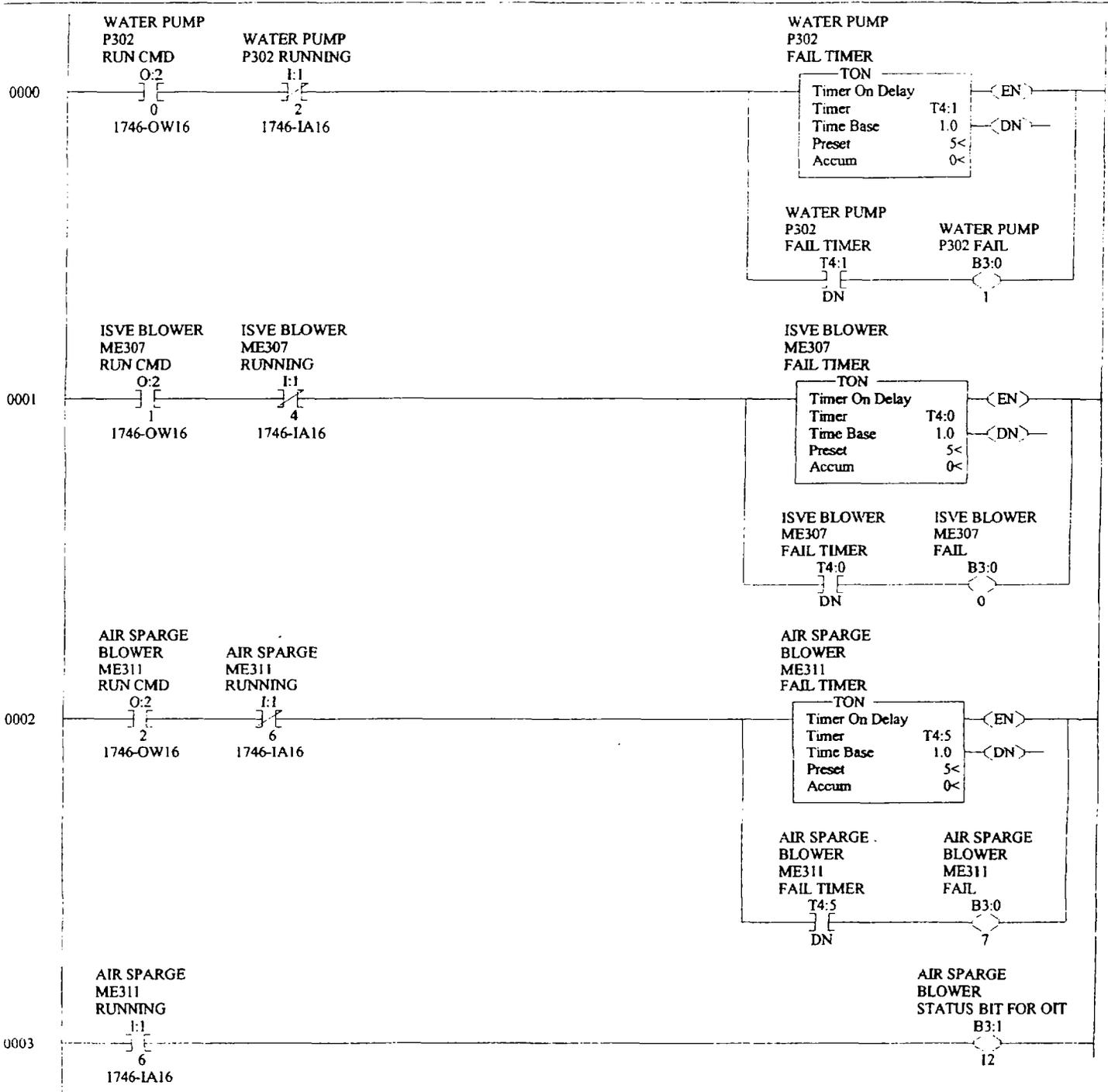


MWH On-site

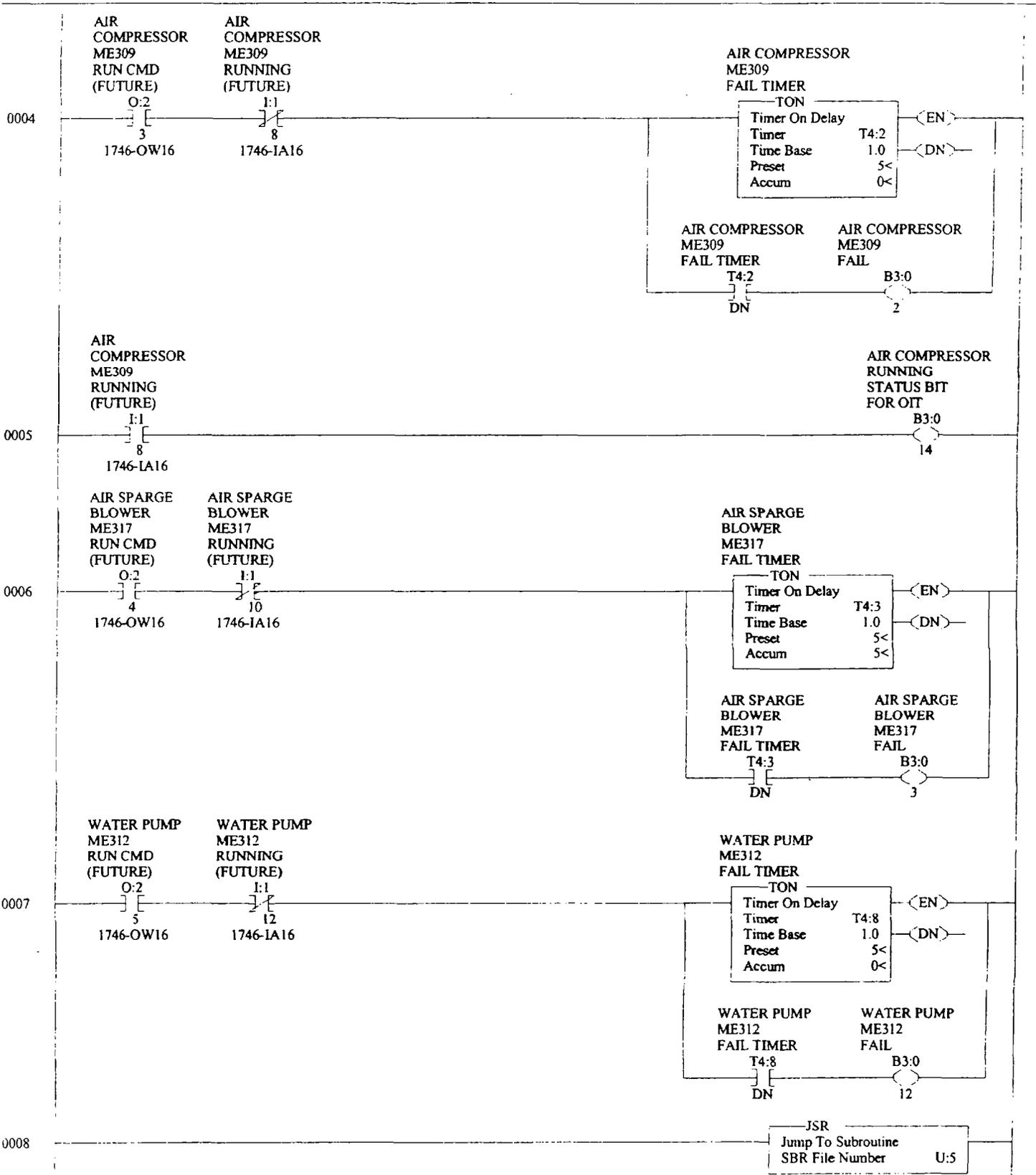
LAD 3 - CONTROLS --- Total Rungs in File = 16



LAD 4 - ALARMS --- Total Rungs in File = 10



LAD 4 - ALARMS --- Total Rungs in File = 10



MWH On-site

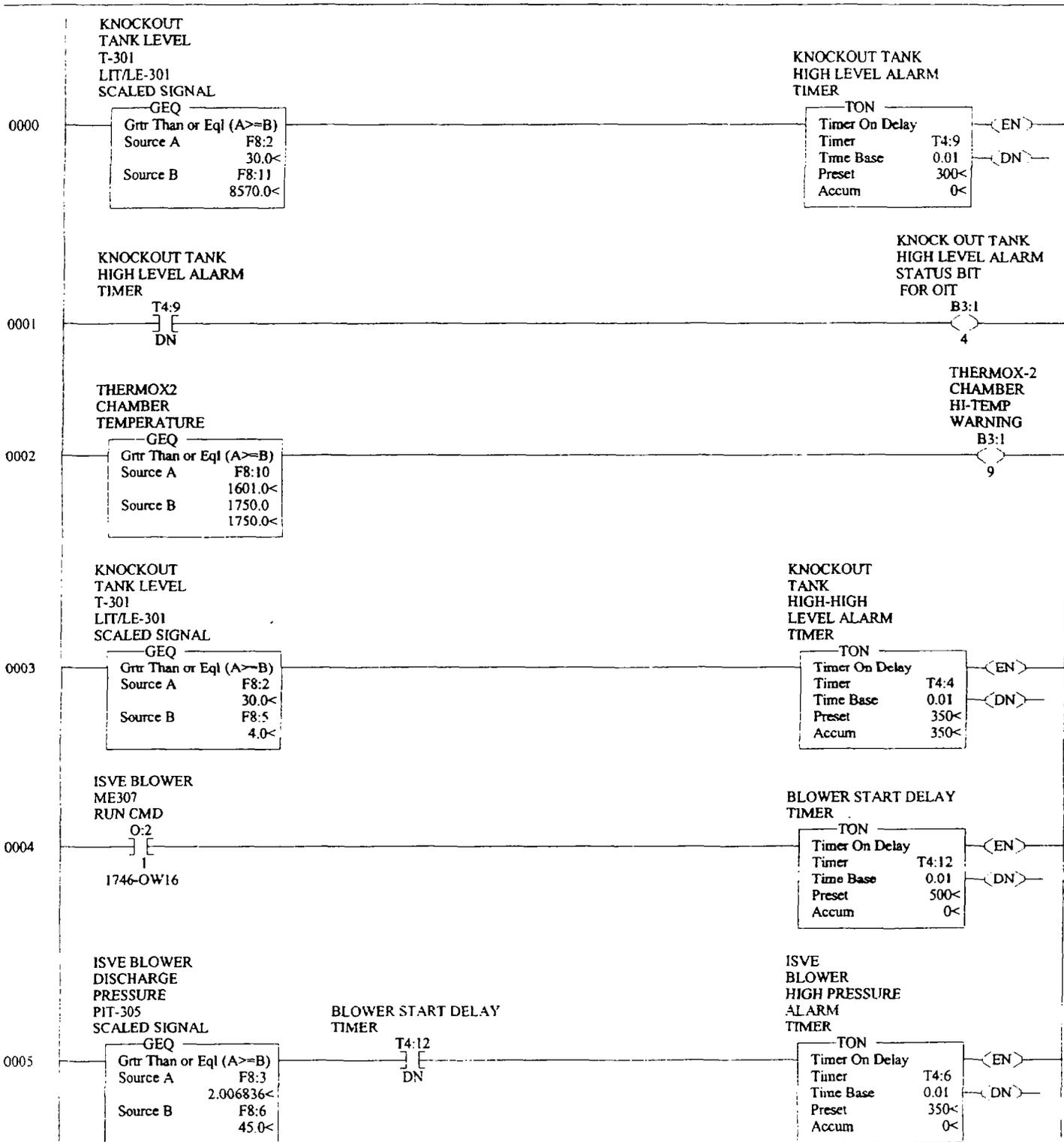
LAD 4 - ALARMS --- Total Rungs in File = 10

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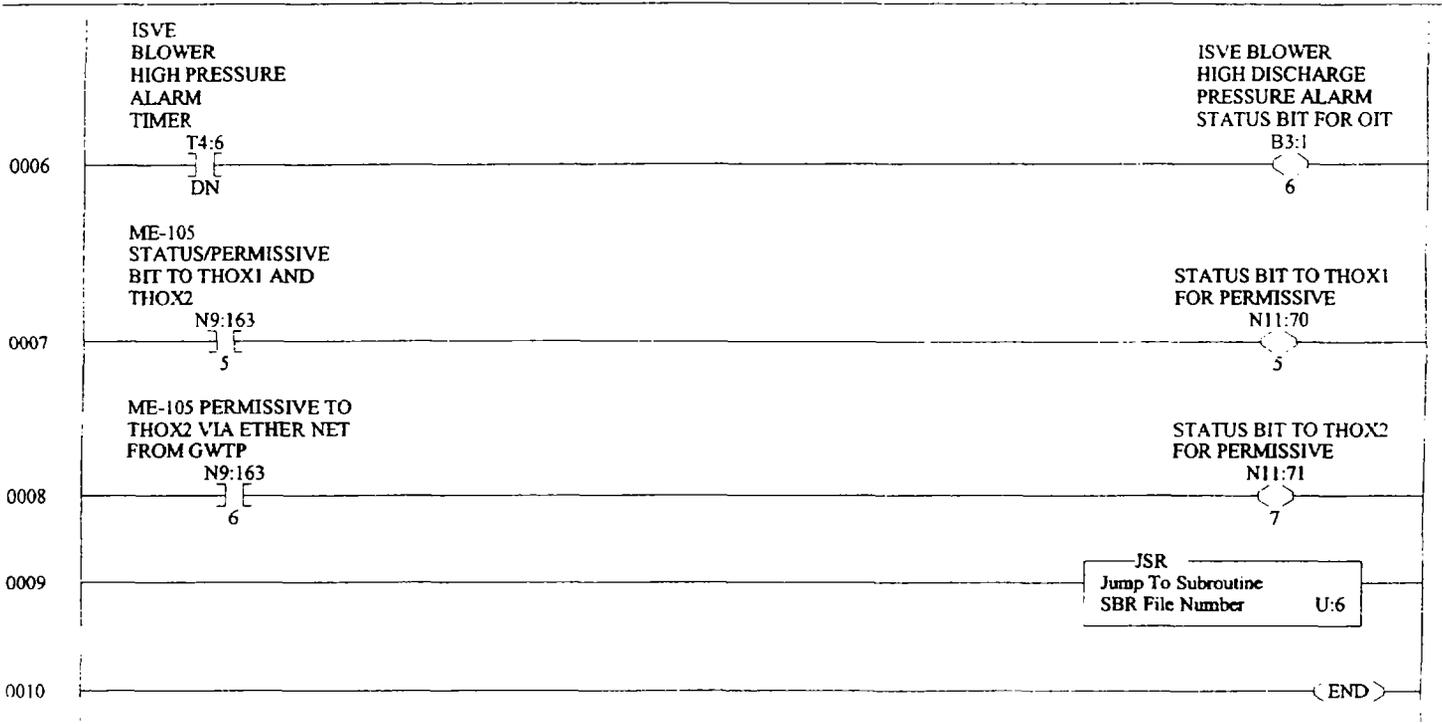
0009

(END)

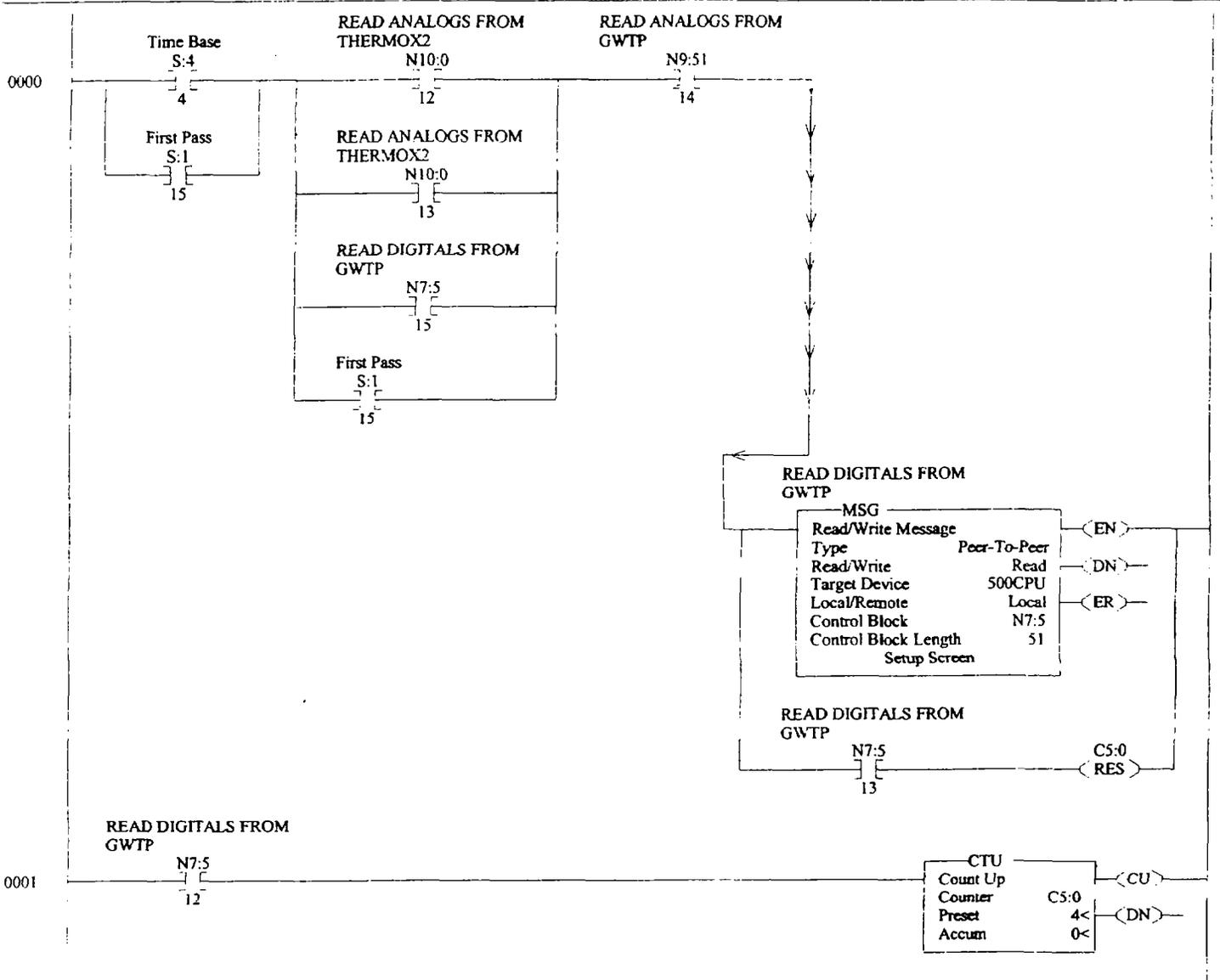
LAD 5 - PERMISSIVE - PERMISSIVES --- Total Rungs in File = 11



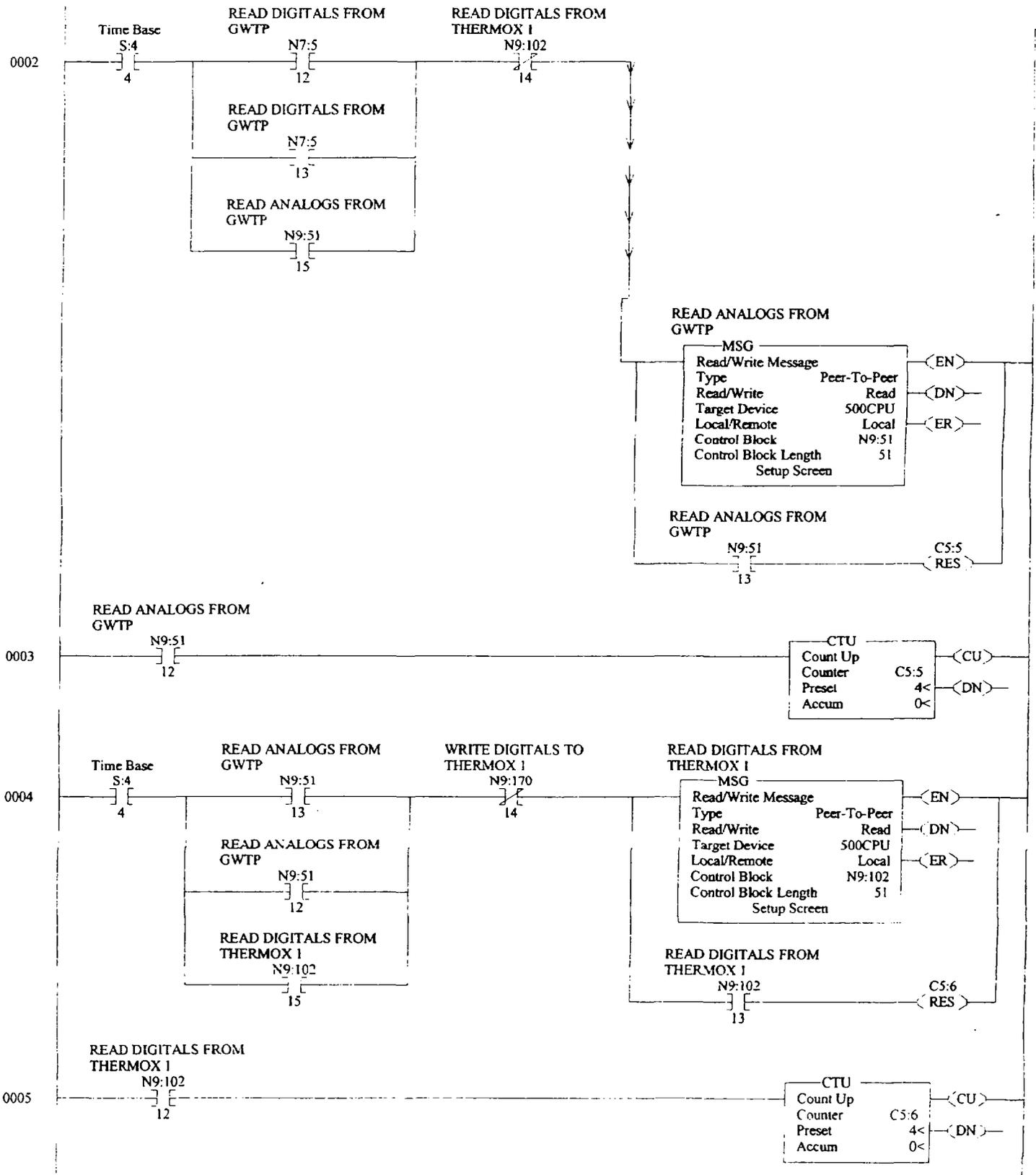
LAD 5 - PERMISSIVE - PERMISSIVES --- Total Rungs in File = 11



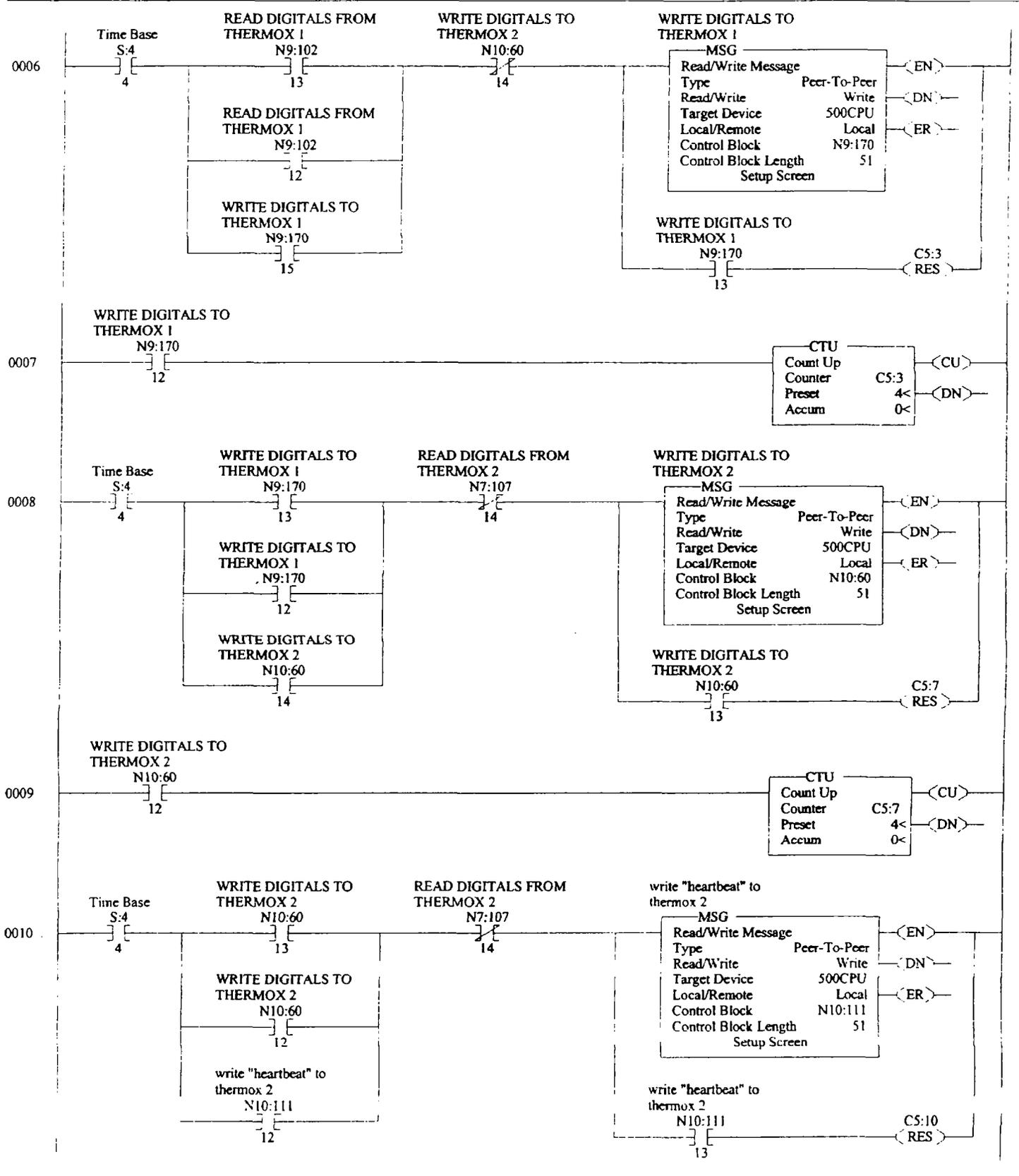
LAD 6 - COMMS - MSG INSTRUCTION FOR E-NET COMM --- Total Rungs in File = 20



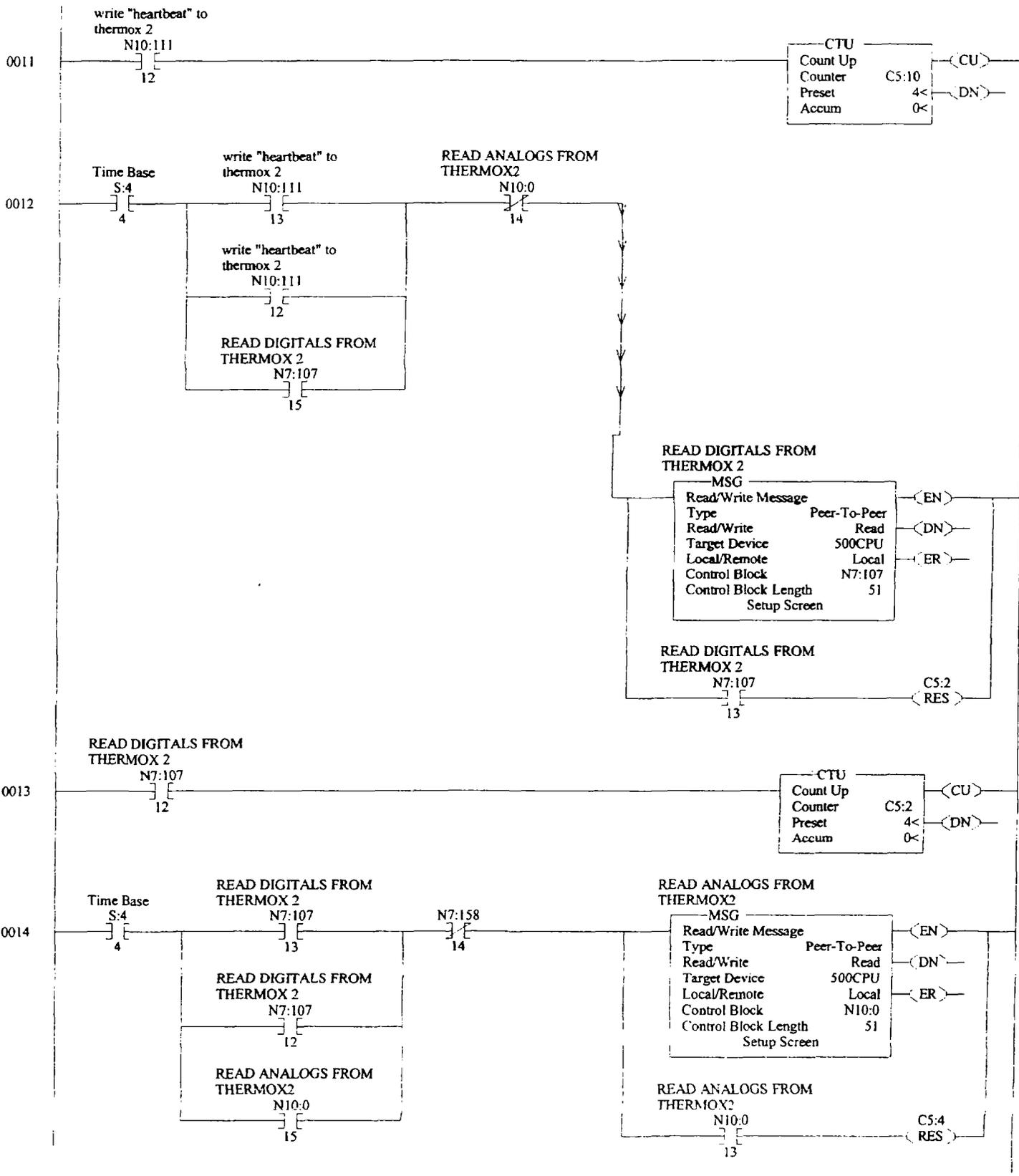
LAD 6 - COMMS - MSG INSTRUCTION FOR E-NET COMM --- Total Rungs in File = 20



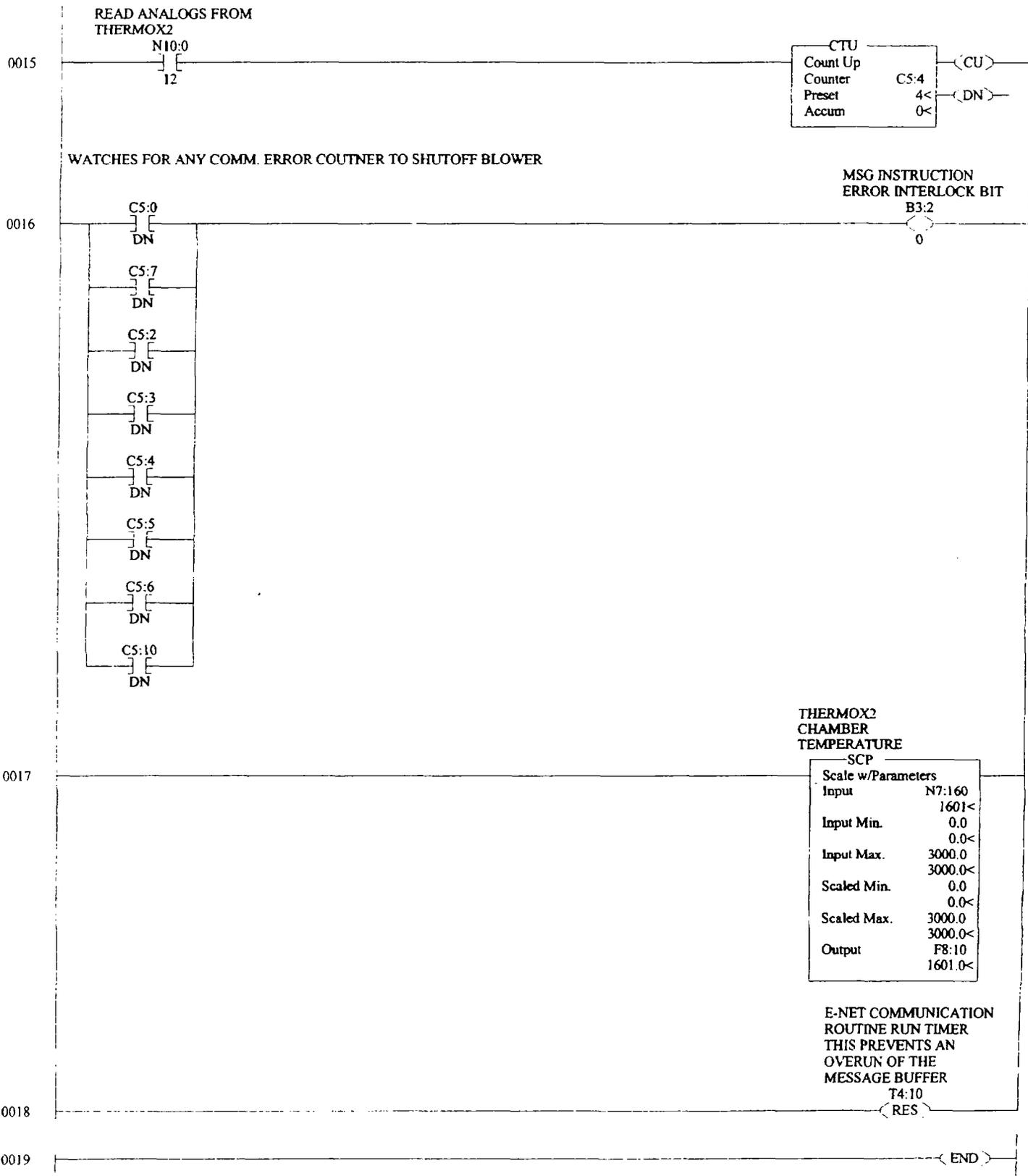
LAD 6 - COMMS - MSG INSTRUCTION FOR E-NET COMM --- Total Rungs in File = 20



LAD 6 - COMMS - MSG INSTRUCTION FOR E-NET COMM --- Total Rungs in File = 20

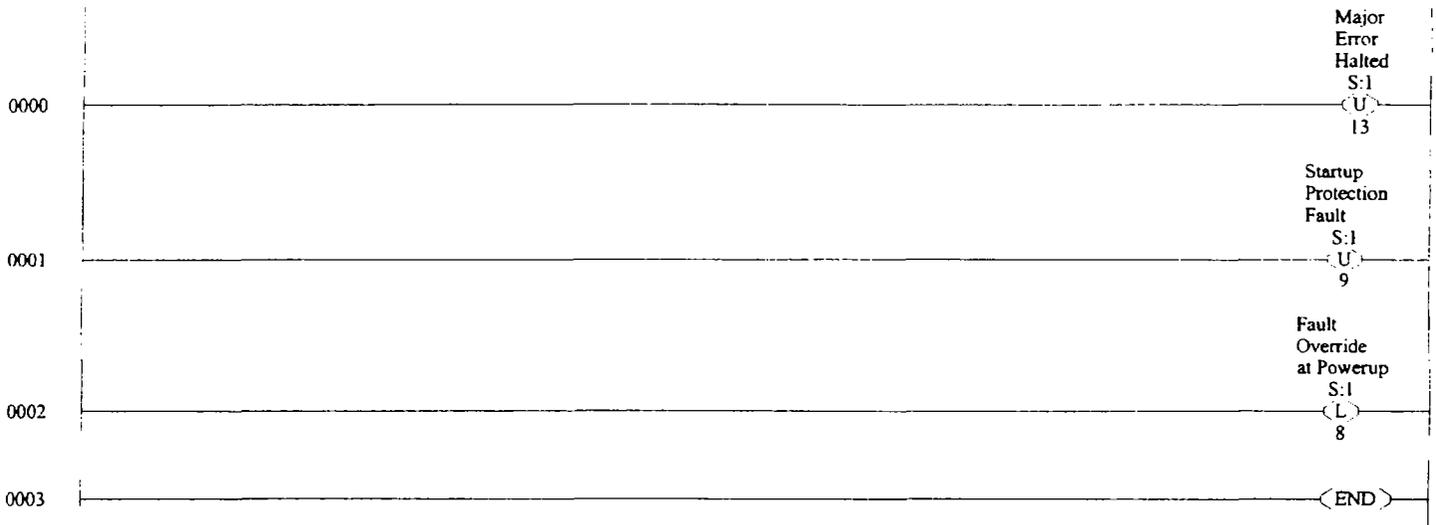


LAD 6 - COMMS - MSG INSTRUCTION FOR E-NET COMM --- Total Rungs in File = 20



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LAD 15 - FAULT --- Total Rungs in File = 4



MWH On-site

RSLogix 500 Cross Reference Report - Sorted by Address

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O:2/0 - WATER PUMP P302 RUN CMD  
       OTE - File #3 CONTROLS - 9  
       XIC - File #4 ALARMS - 0  
 O:2/1 - ISVE BLOWER ME307 RUN CMD  
       OTE - File #3 CONTROLS - 0  
       XIC - File #3 CONTROLS - 0  
       File #4 ALARMS - 1  
       File #5 PERMISSIVE - 4  
 O:2/2 - AIR SPARGE BLOWER ME311 RUN CMD  
       OTE - File #3 CONTROLS - 6  
       XIC - File #3 CONTROLS - 6  
       File #4 ALARMS - 2  
 O:2/3 - AIR COMPRESSOR ME309 RUN CMD (FUTURE)  
       OTE - File #3 CONTROLS - 7  
       XIC - File #3 CONTROLS - 7  
       File #4 ALARMS - 4  
 O:2/4 - AIR SPARGE BLOWER ME317 RUN CMD (FUTURE)  
       XIC - File #4 ALARMS - 6  
 O:2/5 - WATER PUMP ME312 RUN CMD (FUTURE)  
       XIC - File #4 ALARMS - 7  
 O:2/6 - DILUTION AIR S304 OPEN CMD  
       OTE - File #3 CONTROLS - 8  
 O:2/7 - FIELD WELLS PNUM.PUMPS SOL. VALVE S-314 OPEN CMD  
       OTE - File #3 CONTROLS - 12  
 I:1/1 - WATER PUMP P302 IN AUTO  
       XIC - File #3 CONTROLS - 9  
 I:1/2 - WATER PUMP P302 RUNNING  
       XIC - File #3 CONTROLS - 10  
       XIO - File #4 ALARMS - 0  
 I:1/3 - ISVE BLOWER ME307 IN AUTO  
       XIC - File #3 CONTROLS - 0  
 I:1/4 - ISVE BLOWER ME307 RUNNING  
       XIC - File #3 CONTROLS - 5, 6  
       XIO - File #4 ALARMS - 1  
 I:1/5 - AIR SPARGE BLOWER ME311 IN AUTO  
       XIC - File #3 CONTROLS - 6  
 I:1/6 - AIR SPARGE ME311 RUNNING  
       XIC - File #4 ALARMS - 3  
       XIO - File #4 ALARMS - 2  
 I:1/7 - AIR COMPRESSOR ME309 IN AUTO (FUTURE)  
       XIC - File #3 CONTROLS - 7  
 I:1/8 - AIR COMPRESSOR ME309 RUNNING (FUTURE)  
       XIC - File #4 ALARMS - 5  
       XIO - File #4 ALARMS - 4  
 I:1/10 - AIR SPARGE BLOWER ME317 RUNNING (FUTURE)  
       XIO - File #4 ALARMS - 6  
 I:1/12 - WATER PUMP ME312 RUNNING (FUTURE)  
       XIO - File #4 ALARMS - 7  
 I:1/13 - DILUTION AIR VALVE S304 IN AUTO  
       XIC - File #3 CONTROLS - 8  
 I:1/14 - SOLENOID VALVE S314 IN AUTO  
       XIC - File #3 CONTROLS - 12  
 I:6.0 - DILUTION AIR FLOW FIT/FE-300  
       MOV - File #2 ANALOG IN - 0  
 I:6.1 - HEADER AIR FLOW FIT/FE-301  
       MOV - File #2 ANALOG IN - 4  
 I:6.2 - KNOCK-OUT TANK I301 LEVEL LIT/LE-301  
       MOV - File #2 ANALOG IN - 8  
 I:6.3 - ISVE BLOWER ME307 DISCHARGE PRESSURE PIT-305  
       MOV - File #2 ANALOG IN - 12

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MWH On-site

RSLogix 500 Cross Reference Report - Sorted by Address

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I:6.4 - ISVE BLOWER ME307 DISCHARGE FLOW PIT-305  
 MOV - File #2 ANALOG IN - 16

I:6.5 - New Level Transmitter 10/6/03  
 MOV - File #2 ANALOG IN - 20

S:1/8 - Fault Override at Powerup  
 OTL - File #15 FAULT - 2

S:1/9 - Startup Protection Fault  
 OTU - File #15 FAULT - 1

S:1/13 - Major Error Halted  
 OTU - File #15 FAULT - 0

S:1/15 - First Pass  
 XIC - File #6 COMMS - 0

S:4/4 - XIC - File #6 COMMS - 0, 2, 4, 6, 8, 10, 12, 14

B3:0/0 - ISVE BLOWER ME307 FAIL  
 OTE - File #4 ALARMS - 1

B3:0/1 - WATER PUMP P302 FAIL  
 OTE - File #4 ALARMS - 0

B3:0/2 - AIR COMPRESSOR ME309 FAIL  
 OTE - File #4 ALARMS - 4

B3:0/3 - AIR SPARGE BLOWER ME317 FAIL  
 OTE - File #4 ALARMS - 6

B3:0/4 - START PUSH BUTTON FROM OIT  
 XIC - File #3 CONTROLS - 0

B3:0/5 - START PUSH BUTTON FROM SCADA  
 OTU - File #3 CONTROLS - 1  
 XIC - File #3 CONTROLS - 0, 1

B3:0/6 - STOP PUSH BUTTON FROM OIT  
 XIO - File #3 CONTROLS - 0

B3:0/7 - AIR SPARGE BLOWER ME311 FAIL  
 OTE - File #4 ALARMS - 2

B3:0/8 - STOP PUSH BUTTON FROM SCADA  
 OTU - File #3 CONTROLS - 2  
 XIC - File #3 CONTROLS - 2  
 XIO - File #3 CONTROLS - 0

B3:0/9 - THERMOX1 SELECTED FROM SCADA  
 XIC - File #3 CONTROLS - 8

B3:0/10 - THERMOX2 SELECTED FROM SCADA  
 XIC - File #3 CONTROLS - 8

B3:0/11 - CATOX SELECTED FROM SCADA  
 XIC - File #3 CONTROLS - 8

B3:0/12 - WATER PUMP ME312 FAIL  
 OTE - File #4 ALARMS - 7

B3:0/13 - DILUTION AIR SOL VALVE STATUS BIT FOR OIT  
 OTE - File #3 CONTROLS - 8

B3:0/14 - AIR COMPRESSOR RUNNING STATUS BIT FOR OIT  
 OTE - File #4 ALARMS - 5

B3:0/15 - AIR SPARGE START PUSHBUTTON FROM OIT  
 XIC - File #3 CONTROLS - 6

B3:1/0 - WATER PUMP P302 STATUS BIT FOR OIT  
 OTE - File #3 CONTROLS - 10

B3:1/1 - ISVE BLOWER STATUS BIT FOR OIT  
 OTE - File #3 CONTROLS - 5

B3:1/2 - AIR SPARGE STOP PUSHBUTTON FROM OIT  
 XIO - File #3 CONTROLS - 6

B3:1/3 - AIR SPARGE STATUS BIT FOR OIT  
 OTE - File #3 CONTROLS - 6

B3:1/4 - KNOCK OUT TANK HIGH LEVEL ALARM STATUS BIT FOR OIT  
 OTE - File #5 PERMISSIVE - 1

B3:1/5 - AIR COMPRESSOR START PUSHBUTTON FROM OIT  
 XIC - File #3 CONTROLS - 7

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MWH On-site

RSLogix 500 Cross Reference Report - Sorted by Address

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B3:1/6	- ISVE BLOWER HIGH DISCHARGE PRESSURE ALARM STATUS BIT FOR OIT OTE - File #5 PERMISSIVE - 6
B3:1/7	- AIR COMPRESSOR STOP PUSHBUTTON FROM OIT XIO - File #3 CONTROLS - 7
B3:1/8	- AIR COMPRESSOR STATUS BIT FOR OIT OTE - File #3 CONTROLS - 7
B3:1/9	- THERMOX-2 CHAMBER HI-TEMP WARNING OTE - File #5 PERMISSIVE - 2 XIO - File #3 CONTROLS - 0
B3:1/10	- SPARGE BLWR START PB FROM SCADA XIC - File #3 CONTROLS - 6
B3:1/11	- SPARGE BLWR STOP PB FROM SCADA XIO - File #3 CONTROLS - 6
B3:1/12	- AIR SPARGE BLOWER STATUS BIT FOR OIT OTE - File #4 ALARMS - 3
B3:2/0	- MSG INSTRUCTION ERROR INTERLOCK BIT OTE - File #6 COMMS - 16 XIO - File #3 CONTROLS - 0, 6
B3:3/0	- THERMOX 1 SELECTED FROM SCADA XIC - File #3 CONTROLS - 0
B3:3/1	- THERMOX 2 SELECTED FROM SCADA XIC - File #3 CONTROLS - 0
B3:10/0	- THERMOX2 PERMISSIVE STATUS BIT FOR OIT OTE - File #3 CONTROLS - 3
B3:10/1	- THERMOX1 PERMISSIVE FOR OIT DISPLAY OTE - File #3 CONTROLS - 4
T4:0	- ISVE BLOWER ME307 FAIL TIMER TON - File #4 ALARMS - 1
T4:0/DN	- XIC - File #4 ALARMS - 1
T4:1	- WATER PUMP P302 FAIL TIMER TON - File #4 ALARMS - 0
T4:1/DN	- XIC - File #4 ALARMS - 0
T4:2	- AIR COMPRESSOR ME309 FAIL TIMER TON - File #4 ALARMS - 4
T4:2/DN	- XIC - File #4 ALARMS - 4
T4:3	- AIR SPARGE BLOWER ME317 FAIL TIMER TON - File #4 ALARMS - 6
T4:3/DN	- XIC - File #4 ALARMS - 6
T4:4	- KNOCKOUT TANK HIGH-HIGH LEVEL ALARM TIMER TON - File #5 PERMISSIVE - 3
T4:4/DN	- XIO - File #3 CONTROLS - 0
T4:5	- AIR SPARGE BLOWER ME311 FAIL TIMER TON - File #4 ALARMS - 2
T4:5/DN	- XIC - File #4 ALARMS - 2
T4:6	- ISVE BLOWER HIGH PRESSURE ALARM TIMER TON - File #5 PERMISSIVE - 5
T4:6/DN	- XIC - File #5 PERMISSIVE - 6 XIO - File #3 CONTROLS - 0
T4:7	- DILUTION AIR VALVE OPEN TIMER TON - File #3 CONTROLS - 0
T4:7/TT	- XIC - File #3 CONTROLS - 8
T4:8	- WATER PUMP ME312 FAIL TIMER TON - File #4 ALARMS - 7
T4:8/DN	- XIC - File #4 ALARMS - 7
T4:9	- KNOCKOUT TANK HIGH LEVEL ALARM TIMER TON - File #5 PERMISSIVE - 0
T4:9/DN	- XIC - File #5 PERMISSIVE - 1
T4:10	- E-NET COMMUNICATION ROUTINE RUN TIMER THIS PREVENTS AN OVERUN OF THE MES RES - File #6 COMMS - 18
T4:11	- TON - File #3 CONTROLS - 1

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## MWH On-site

## RSLogix 500 Cross Reference Report - Sorted by Address

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T4:11/DN - XIC - File #3 CONTROLS - 1
T4:12 - BLOWER START DELAY TIMER
      TON - File #5 PERMISSIVE - 4
T4:12/DN - XIC - File #5 PERMISSIVE - 5
T4:13 - s-314 buffer timer
      TON - File #3 CONTROLS - 11
T4:13/DN - XIO - File #3 CONTROLS - 12
T4:20 - TON - File #3 CONTROLS - 2
T4:20/DN - XIC - File #3 CONTROLS - 2
C5:0 - CTU - File #6 COMMS - 1
      RES - File #6 COMMS - 0
C5:0/DN - XIC - File #6 COMMS - 16
C5:2 - CTU - File #6 COMMS - 13
      RES - File #6 COMMS - 12
C5:2/DN - XIC - File #6 COMMS - 16
C5:3 - CTU - File #6 COMMS - 7
      RES - File #6 COMMS - 6
C5:3/DN - XIC - File #6 COMMS - 16
C5:4 - CTU - File #6 COMMS - 15
      RES - File #6 COMMS - 14
C5:4/DN - XIC - File #6 COMMS - 16
C5:5 - CTU - File #6 COMMS - 3
      RES - File #6 COMMS - 2
C5:5/DN - XIC - File #6 COMMS - 16
C5:6 - CTU - File #6 COMMS - 5
      RES - File #6 COMMS - 4
C5:6/DN - XIC - File #6 COMMS - 16
C5:7 - CTU - File #6 COMMS - 9
      RES - File #6 COMMS - 8
C5:7/DN - XIC - File #6 COMMS - 16
C5:10 - CTU - File #6 COMMS - 11
      RES - File #6 COMMS - 10
C5:10/DN - XIC - File #6 COMMS - 16
N7:0 - DILUTION AIR FLOW RAW SIGNAL
      MOV - File #2 ANALOG IN - 0, 1, 2
      SCP - File #2 ANALOG IN - 3
      GRT - File #2 ANALOG IN - 2
      LES - File #2 ANALOG IN - 1
N7:1 - HEADER FLOW FIT/FE-301 RAW SIGNAL
      MOV - File #2 ANALOG IN - 4, 5, 6
      SCP - File #2 ANALOG IN - 7
      GRT - File #2 ANALOG IN - 6
      LES - File #2 ANALOG IN - 5
N7:2 - KNOCKOUT TANK LEVEL T-301 LIT/LE-301 RAW SIGNAL
      MOV - File #2 ANALOG IN - 8, 9, 10
      SCP - File #2 ANALOG IN - 11
      GRT - File #2 ANALOG IN - 10
      LES - File #2 ANALOG IN - 9
N7:3 - ISVE BLOWER DISCHARGE PRESSURE PIT-305 RAW SIGNAL
      MOV - File #2 ANALOG IN - 12, 13, 14
      SCP - File #2 ANALOG IN - 15
      GRT - File #2 ANALOG IN - 14
      LES - File #2 ANALOG IN - 13
N7:4 - ISVE BLOWER DISCHARGE FLOW FIT/FE-302 RAW SIGNAL
      MOV - File #2 ANALOG IN - 16, 17, 18
      SCP - File #2 ANALOG IN - 19
      GRT - File #2 ANALOG IN - 18
      LES - File #2 ANALOG IN - 17
N7:5 - READ DIGITALS FROM GWTP
      MSG - File #6 COMMS - 0

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## RSLogix 500 Cross Reference Report - Sorted by Address

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FILE N7:5 LEN:51 - MSG - File #6 COMMS - 0
N7:5/12 - XIC - File #6 COMMS - 1, 2
FILE N7:5/12 LEN:51 - MSG - File #6 COMMS - 0
N7:5/13 - XIC - File #6 COMMS - 0, 2
FILE N7:5/13 LEN:51 - MSG - File #6 COMMS - 0
N7:5/15 - XIC - File #6 COMMS - 0
FILE N7:5/15 LEN:51 - MSG - File #6 COMMS - 0
N7:57 - raw level transmitter 10/6/03
      MOV - File #2 ANALOG IN - 20, 21, 22
      SCP - File #2 ANALOG IN - 23
      GRT - File #2 ANALOG IN - 22
      LES - File #2 ANALOG IN - 21
N7:107 - READ DIGITALS FROM THERMOX 2
      MSG - File #6 COMMS - 12
FILE N7:107 LEN:51 - MSG - File #6 COMMS - 12
N7:107/12 - XIC - File #6 COMMS - 13, 14
FILE N7:107/12 LEN:51 - MSG - File #6 COMMS - 12
N7:107/13 - XIC - File #6 COMMS - 12, 14
FILE N7:107/13 LEN:51 - MSG - File #6 COMMS - 12
N7:107/14 - XIO - File #6 COMMS - 8, 10
FILE N7:107/14 LEN:51 - MSG - File #6 COMMS - 12
N7:107/15 - XIC - File #6 COMMS - 12
FILE N7:107/15 LEN:51 - MSG - File #6 COMMS - 12
N7:158/14 - XIO - File #6 COMMS - 14
N7:160 - SCP - File #6 COMMS - 17
      MSG - File #6 COMMS - 14
FILE N7:160 LEN:1 - MSG - File #6 COMMS - 14
F8:0 - DILUTION AIR FLOW SCALED SIGNAL
      SCP - File #2 ANALOG IN - 3
F8:1 - HEADER FLOW FIT/FE-301 SCALED SIGNAL
      SCP - File #2 ANALOG IN - 7
F8:2 - KNOCKOUT TANK LEVEL T-301 LIT/LE-301 SCALED SIGNAL
      SCP - File #2 ANALOG IN - 11
      GRT - File #3 CONTROLS - 9
      GEQ - File #5 PERMISSIVE - 0, 3
F8:3 - ISVE BLOWER DISCHARGE PRESSURE PIT-305 SCALED SIGNAL
      SCP - File #2 ANALOG IN - 15
      GEQ - File #5 PERMISSIVE - 5
F8:4 - ISVE BLOWER DISCHARGE FLOW FIT/FE-302 SCALED SIGNAL
      SCP - File #2 ANALOG IN - 19
F8:5 - GEQ - File #5 PERMISSIVE - 3
F8:6 - GEQ - File #5 PERMISSIVE - 5
F8:7 - GRT - File #3 CONTROLS - 9
F8:8 - THERMOX1 HI-TEMP SHUTDOWN SETPOINT FROM SCADA
      GRT - File #3 CONTROLS - 8
F8:9 - GRT - File #3 CONTROLS - 9
F8:10 - THERMOX2 CHAMBER TEMPERATURE
      SCP - File #6 COMMS - 17
      GRT - File #3 CONTROLS - 8
      GEQ - File #5 PERMISSIVE - 2
F8:11 - KNOCK OUT TANK HIGH LEVEL ALARM SET POINT
      GEQ - File #5 PERMISSIVE - 0
F8:12 - CATOX SHUTDOWN TEMPERATURE SETPOINT FROM SCADA
      GRT - File #3 CONTROLS - 8
F8:13 - new level transmitter scaled 10/6/03
      SCP - File #2 ANALOG IN - 23
F8:30 - THERMOX1 CHAMBER TEMPERATURE
      GRT - File #3 CONTROLS - 8
F8:40 - THERMOX2 CHAMBER TEMPERATURE
      GRT - File #3 CONTROLS - 8

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## RSLogix 500 Cross Reference Report - Sorted by Address

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F8:50      - CATOX CHAMBER TEMPERATURE
            GRT - File #3 CONTROLS - 8
N9:51      - READ ANALOGS FROM GWTP
            MSG - File #6 COMMS - 2
FILE N9:51 LEN:51 - MSG - File #6 COMMS - 2
N9:51/12   - XIC - File #6 COMMS - 3, 4
FILE N9:51/12 LEN:51 - MSG - File #6 COMMS - 2
N9:51/13   - XIC - File #6 COMMS - 2, 4
FILE N9:51/13 LEN:51 - MSG - File #6 COMMS - 2
N9:51/14   - XIO - File #6 COMMS - 0
FILE N9:51/14 LEN:51 - MSG - File #6 COMMS - 2
N9:51/15   - XIC - File #6 COMMS - 2
FILE N9:51/15 LEN:51 - MSG - File #6 COMMS - 2
N9:102     - READ DIGITALS FROM THERMOX 1
            MSG - File #6 COMMS - 4
FILE N9:102 LEN:51 - MSG - File #6 COMMS - 4
N9:102/12  - XIC - File #6 COMMS - 5, 6
FILE N9:102/12 LEN:51 - MSG - File #6 COMMS - 4
N9:102/13  - XIC - File #6 COMMS - 4, 6
FILE N9:102/13 LEN:51 - MSG - File #6 COMMS - 4
N9:102/14  - XIO - File #6 COMMS - 2
FILE N9:102/14 LEN:51 - MSG - File #6 COMMS - 4
N9:102/15  - XIC - File #6 COMMS - 4
FILE N9:102/15 LEN:51 - MSG - File #6 COMMS - 4
N9:160     - MSG - File #6 COMMS - 4
FILE N9:160 LEN:1 - MSG - File #6 COMMS - 4
N9:160/0   - THERMOX1 PERMISSIVE
            XIC - File #3 CONTROLS - 0
FILE N9:160/0 LEN:1 - MSG - File #6 COMMS - 4
N9:161     - MSG - File #6 COMMS - 12
FILE N9:161 LEN:1 - MSG - File #6 COMMS - 12
N9:161/0   - THERMOX1 READY SIGNAL
            XIC - File #3 CONTROLS - 4
FILE N9:161/0 LEN:1 - MSG - File #6 COMMS - 12
N9:161/1   - THERMOX2 PERMISSIVE
            XIC - File #3 CONTROLS - 0, 3
FILE N9:161/1 LEN:1 - MSG - File #6 COMMS - 12
N9:163     - MSG - File #6 COMMS - 0
FILE N9:163 LEN:1 - MSG - File #6 COMMS - 0
N9:163/0   - T-102 AND GENERAL ALARM PERMISSIVE FROM GWTP
            XIC - File #3 CONTROLS - 11
            XIO - File #3 CONTROLS - 9
FILE N9:163/0 LEN:1 - MSG - File #6 COMMS - 0
N9:163/5   - ME-105 STATUS/PERMISSIVE BIT TO THOX1 AND THOX2
            XIC - File #5 PERMISSIVE - 7
FILE N9:163/5 LEN:1 - MSG - File #6 COMMS - 0
N9:163/6   - ME-105 PERMISSIVE TO THOX2 VIA ETHER NET FROM GWTP
            XIC - File #5 PERMISSIVE - 8
FILE N9:163/6 LEN:1 - MSG - File #6 COMMS - 0
N9:170     - WRITE DIGITALS TO THERMOX 1
            MSG - File #6 COMMS - 6
FILE N9:170 LEN:51 - MSG - File #6 COMMS - 6
N9:170/12  - XIC - File #6 COMMS - 7, 8
FILE N9:170/12 LEN:51 - MSG - File #6 COMMS - 6
N9:170/13  - XIC - File #6 COMMS - 6, 8
FILE N9:170/13 LEN:51 - MSG - File #6 COMMS - 6
N9:170/14  - XIO - File #6 COMMS - 4
FILE N9:170/14 LEN:51 - MSG - File #6 COMMS - 6
N9:170/15  - XIC - File #6 COMMS - 6
FILE N9:170/15 LEN:51 - MSG - File #6 COMMS - 6

```

## RSLogix 500 Cross Reference Report - Sorted by Address

```

N10:0      - READ ANALOGS FROM THERMOX2
            MSG - File #6 COMMS - 14
FILE N10:0 LEN:51 - MSG - File #6 COMMS - 14
N10:0/12   - XIC - File #6 COMMS - 0, 15
FILE N10:0/12 LEN:51 - MSG - File #6 COMMS - 14
N10:0/13   - XIC - File #6 COMMS - 0, 14
FILE N10:0/13 LEN:51 - MSG - File #6 COMMS - 14
N10:0/14   - XIO - File #6 COMMS - 12
FILE N10:0/14 LEN:51 - MSG - File #6 COMMS - 14
N10:0/15   - XIC - File #6 COMMS - 14
FILE N10:0/15 LEN:51 - MSG - File #6 COMMS - 14
N10:60     - WRITE DIGITALS TO THERMOX 2
            MSG - File #6 COMMS - 8
FILE N10:60 LEN:51 - MSG - File #6 COMMS - 8
N10:60/12  - XIC - File #6 COMMS - 9, 10
FILE N10:60/12 LEN:51 - MSG - File #6 COMMS - 8
N10:60/13  - XIC - File #6 COMMS - 8, 10
FILE N10:60/13 LEN:51 - MSG - File #6 COMMS - 8
N10:60/14  - XIC - File #6 COMMS - 8
            XIO - File #6 COMMS - 6
FILE N10:60/14 LEN:51 - MSG - File #6 COMMS - 8
N10:111    - write "heartbeat" to thermox 2
            MSG - File #6 COMMS - 10
FILE N10:111 LEN:51 - MSG - File #6 COMMS - 10
N10:111/12 - XIC - File #6 COMMS - 10, 11, 12
FILE N10:111/12 LEN:51 - MSG - File #6 COMMS - 10
N10:111/13 - XIC - File #6 COMMS - 10, 12
FILE N10:111/13 LEN:51 - MSG - File #6 COMMS - 10
N11:70     - MSG - File #6 COMMS - 6
FILE N11:70 LEN:1 - MSG - File #6 COMMS - 6
N11:70/5   - STATUS BIT TO THOX1 FOR PERMISSIVE
            OTE - File #5 PERMISSIVE - 7
FILE N11:70/5 LEN:1 - MSG - File #6 COMMS - 6
N11:70/6   - PERMISSIVE TO THOX 1
            OTE - File #3 CONTROLS - 0
FILE N11:70/6 LEN:1 - MSG - File #6 COMMS - 6
N11:71     - MSG - File #6 COMMS - 8
FILE N11:71 LEN:1 - MSG - File #6 COMMS - 8
N11:71/6   - PERMISSIVE TO THOX 2
            OTE - File #3 CONTROLS - 0
FILE N11:71/6 LEN:1 - MSG - File #6 COMMS - 8
N11:71/7   - STATUS BIT TO THOX2 FOR PERMISSIVE
            OTE - File #5 PERMISSIVE - 8
FILE N11:71/7 LEN:1 - MSG - File #6 COMMS - 8
N11:72     - MSG - File #6 COMMS - 10
FILE N11:72 LEN:1 - MSG - File #6 COMMS - 10
N11:72/0   - heartbeat bit to thermox 2 - always true
            OTE - File #3 CONTROLS - 13
FILE N11:72/0 LEN:1 - MSG - File #6 COMMS - 10
F13:17     - MSG - File #6 COMMS - 2
FILE F13:17 LEN:1 - MSG - File #6 COMMS - 2
N50:0      - Channel Configuration - Channel 1:Diagnostic File
FILE N50:0 LEN:256 - Channel Configuration - Channel 1:Diagnostic File
U:3        - JSR - File #2 ANALOG IN - 24
U:4        - JSR - File #3 CONTROLS - 14
U:5        - JSR - File #4 ALARMS - 8
U:6        - JSR - File #5 PERMISSIVE - 9

```

## **APPENDIX M**

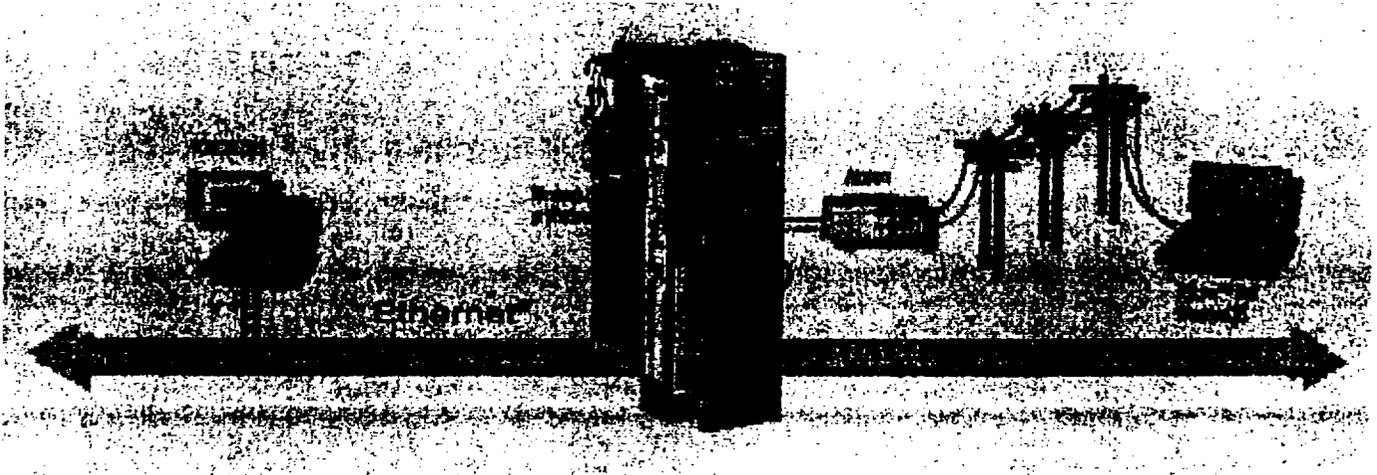
### **CONTROL AND INSTRUMENTATION EQUIPMENT SPECIFICATIONS**



## Connect to the Future Today with Allen-Bradley's SLC 5/05™ Processor with Ethernet®

SLC 5/05 Programmable Controllers  
(Cat. Nos. 1747-L551, -L552, -L553)

Product Profile



*Connected  
With  
Ethernet*

Allen-Bradley's SLC 5/05 Programmable Controllers (1747-L551, 1747-L552, and 1747-L553) provide high bandwidth networking for standards-based distributed programmable controller systems. They bring 10 Mbps Ethernet connectivity to the popular SLC 500™ family of programmable controllers.

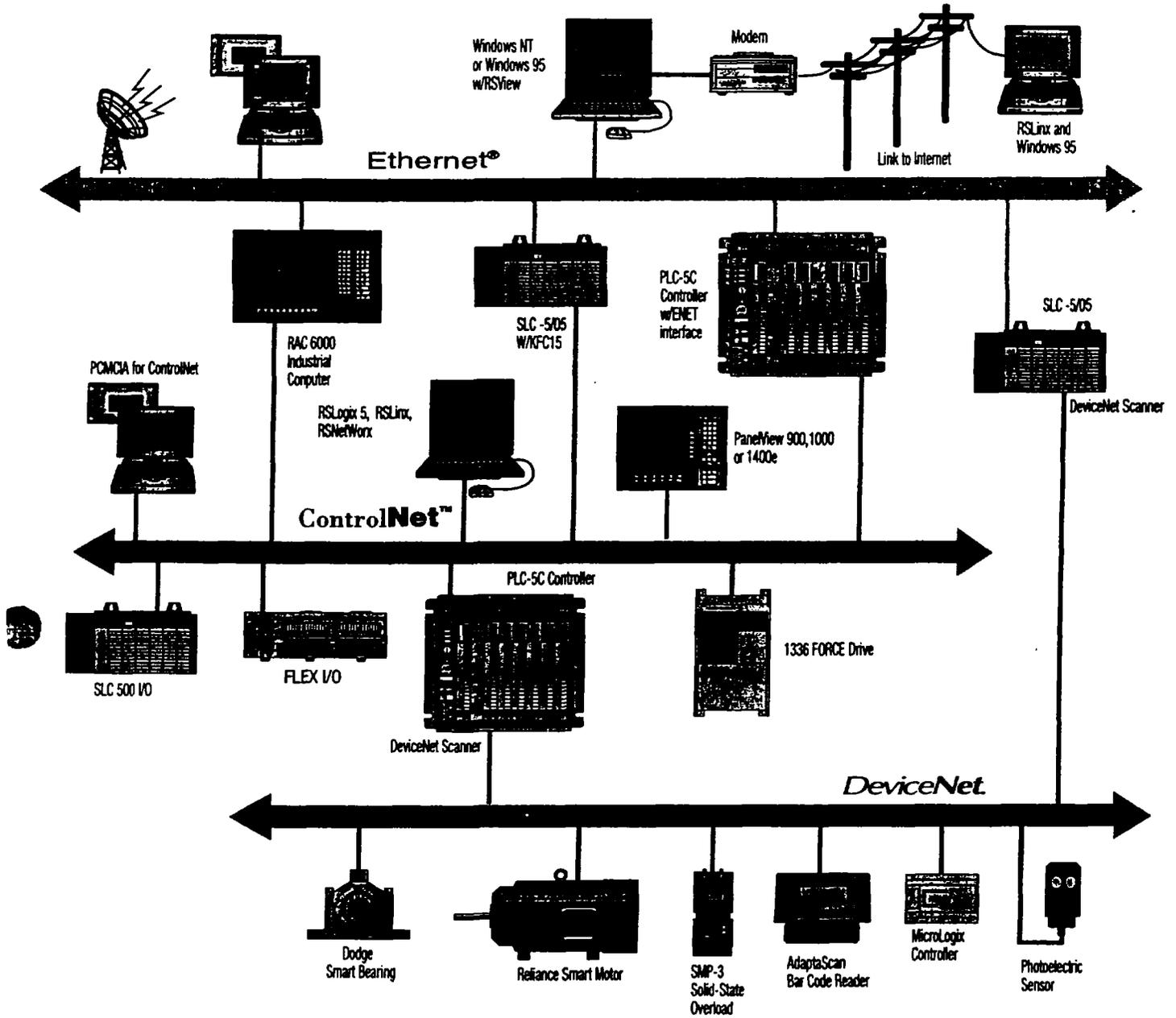
Allen-Bradley supports TCP/IP (Transmission Control Protocol/Internet Protocol), a communication protocol in wide use over Ethernet networks. We integrate control systems with supervisory monitoring and information management systems through the SLC 5/05 processors that support TCP/IP-over-Ethernet communication. Through Ethernet networks, your SLC 5/05 processors can communicate plant-floor data in data acquisition, supervisory control, program management, statistical quality control, maintenance management, production scheduling, and material tracking applications.

We help make it easy for you to use Ethernet networks in applications such as supervisory monitoring and SLC 5/05 processor program management.

### Processor Overview:

- Three processor models (16K, 32K and 64K memory) to fit a wide range of applications
- Built-in 10Base-T Ethernet channel
- 10 Mbps communications – TCP/IP protocol
- Uses widely available Ethernet devices and cabling
- Supports online programming over Ethernet with RSLogix 500™ Programming Software

# System Example



## Features and Benefits

**Supports standard Ethernet communications on Channel 1.** The SLC 5/05 processors support 10Mbps Ethernet communications and use the TCP/IP protocol. The 10Base-T Ethernet channel provides an economical connection to your Ethernet Network.

**Built-in Ethernet, not an add on module.** The SLC 5/05 delivers fast data throughput with no backplane delays.

**The SLC 5/05 Modular Processors provide a second channel (Channel 0) for RS-232 communication.** This allows:

- Dial up for remote monitoring and programming
- Networking over modems for SCADA master/slave RTU applications
- An alternate connection for operator interfaces freeing up peer-to-peer network
- Direct communication to ASCII devices such as bar code decoders and serial printers via a complete set of ASCII ladder instructions which simplify programming
- Direct connection to personal computer

**Channel 0 also supports DH-485 communication.** Communication via the DH-485 network is available in every SLC processor we ship, reducing your system cost for processor communication.

**Supports user memory sizes of 16K, 32K, and 64K.** By offering a wide range of user memory, the SLC 5/05 modular processors can be used in a wide range of applications.

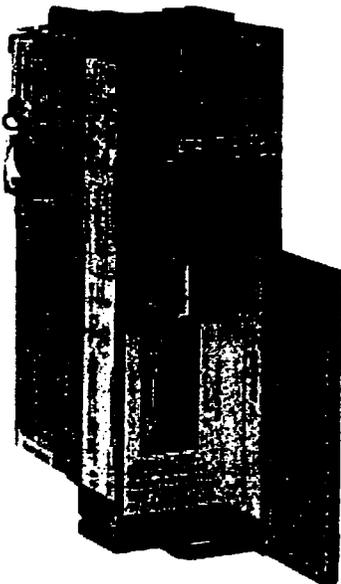
**Supports a variety of input and output modules.** The 1746 modular I/O system offers over 60 types of modules, allowing you to customize your control solution to meet your application needs, including discrete, analog, and specialty modules.

**Supports I/O configurations of up to 3 chassis (30 local I/O slots).** Provides you with the flexibility to expand I/O capacity as required.

**Supports remote I/O and DeviceNet™.** The SLC 5/05 processors support up to 4096 discrete inputs and 4096 discrete outputs. This I/O can be any mix of local I/O, remote I/O, or I/O on a DeviceNet network. This also allows for connectivity to flex I/O.

**Provides user-selectable program security.** The wide range of system protection capabilities allow you to secure user data and program files from changes.

**Supports a host of third-party products through the Allen-Bradley Encompass™ Program.** The Encompass Program provides access to products and services that increase your application capabilities.



**Processor Overview:  
(continued)**

- Supports Simple Network Management Protocol (SNMP) for network management
- Achieves high-speed peer-to-peer programmable controller communications via the SLC 500 message instruction
- High-speed performance – 0.90 ms/K typical scan time
- Built-in real-time clock/calendar, Year 2000 and Leap Year ready
- 1 ms Selectable Timed Interrupt (STI) for use in time critical applications
- 0.50 ms Discrete Input Interrupt (DII) for use in high-speed applications
- Advanced math features – trigonometric, PID, exponential, floating point, and the compute instruction
- Indirect addressing
- Flash PROM enables future firmware upgrades without physically changing EPROMs

**Programming:**

**RSLogix 500**

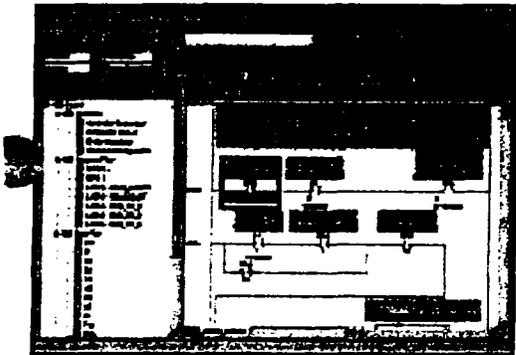
Programming for the SLC 500<sup>®</sup>  
and MicroLogix<sup>™</sup> Families



**RSLogix 500**, a Microsoft<sup>®</sup> 32-bit Windows 95<sup>®</sup> and Windows NT<sup>™</sup> programming software package, supports Allen-Bradley SLC 500 and MicroLogix<sup>™</sup> families of processors. RSLogix 500 is designed to offer powerful functionality, superior diagnostics, reliable communications, and an easy-to-use interface.

RSLogix 500 provides everything you expect in a programming software package, from consolidated project view to drag-and-drop editing. Plus RSLogix 500 is part of the RSLogix family of products that share:

- A common user interface and feature set
- Flexible, easy-to-use editors
- Point-and-click I/O configuration
- Powerful database editor
- Diagnostic and troubleshooting tools
- Dependable communications



**Flexible Ladder Editor**

Create programs without constantly correcting syntax errors, then later use the *Project Verifier* to navigate through the corrections.

**Powerful Database Editor**

Use the Symbol Group Editor to classify a group of symbols for easy reuse from project to project. Use the Symbol Picker to select address or symbols to address ladder instructions. RSLogix 500 symbols may be 20 characters long. Address comments may reach 100 characters (5 lines x 20 characters). Each rung comment may be 65K characters in length. Export your database to Comma-Separated-Value (CSV) format for use in Excel or another spreadsheet program – Import changes back into RSLogix 500.

**Programming Tools**

RSLogix 500 designed for Microsoft Windows 95 and NT (4.0 or later) gives you powerful tools, such as drag and drop, multiple window view, drop down menus and much more.

**Diagnostics & Troubleshooting Tools**

Use Advanced Diagnostics to navigate to an application area that is causing problems. Use the Custom Data Monitor to monitor the status of bits, timers, counters, inputs, and outputs from within one window. Create a unique Custom Data Monitor window for each application.

**Upgradeability and Reusability**

Easily upgrade projects from Rockwell Software DOS programming packages, by opening the existing project in RSLogix 500. Or move a project developed in RSLogix 500 to any of the DOS programming packages.

# SLC 5/05 System Test Specifications

Description	Specification
Temperature	Operating: 0°C to +60°C (+32°F to +140°F)
	Storage: -40°C to +85°C (-40°F to +185°F)
Humidity	5 to 95% without condensation
Vibration	Operating: 1.0G at 5 to 2000 Hz
	Non-operating: 2.5Gs at 5 to 2000 Hz
Shock	Operating: 30.0Gs (3 pulses, 11 ms)
	Non-operating: 50.0Gs (3 pulses, 11 ms)
Free Fall (drop test)	Portable, 2.268 kg (5 lbs) or less at 0.762m (30 in.) (six drops)
	Portable, 2.268 kg (5 lbs) or more at 0.1016m (4 in.) (three flat drops)
Electromagnetic Compatibility	Showering Arc: 1.5 KV Per NEMA ICS 2-230/NEMA ICS 3-304
	Surge Withstand Capability: 3 KV Per IEEE Std. 472-1974/ANSI C37.90/90A-1974
	Fast Transient Burst (impulse): 2 KV for 1746 power supplies, 1 KV for 1746 I/O and communication lines over 10m (32.84 ft), 5 ns rise time
	Electrostatic Discharge (ESD): 15 KV, 100 pF/1.5k ohm model
	Radiated Electromagnetic Susceptibility: 5W walkie-talkie at 464.5 MHz and 153.05 MHz
Safety	Dielectric Withstand: 1500V ac Per UL 508, CSA C22.2 No. 142
	Isolation between Communication Circuits: 500V dc
	Isolation between Backplane and I/Os: 1500V ac
	Flammability and Electrical Ignition: UL94V-0
Certification	UL listed/CSA approved
	Class 1, Groups A, B, C or D, Division 2
	CE compliant for all applicable directives

For more information about the SLC 5/05 processor with built-in Ethernet, as well as other products and services, contact your local Allen-Bradley sales representative, authorized distributor or authorized system integrator.

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DeviceNet is a trademark of Open DeviceNet Vendor Association.

RSLogix 500 is a trademark of Rockwell Software, Inc.



Rockwell Automation helps its customers receive a superior return on their investment by bringing together leading brands in industrial automation, creating a broad spectrum of easy-to-integrate products. These are supported by local technical resources available worldwide, a global network of system solutions providers, and the advanced technology resources of Rockwell.

## Worldwide representation.



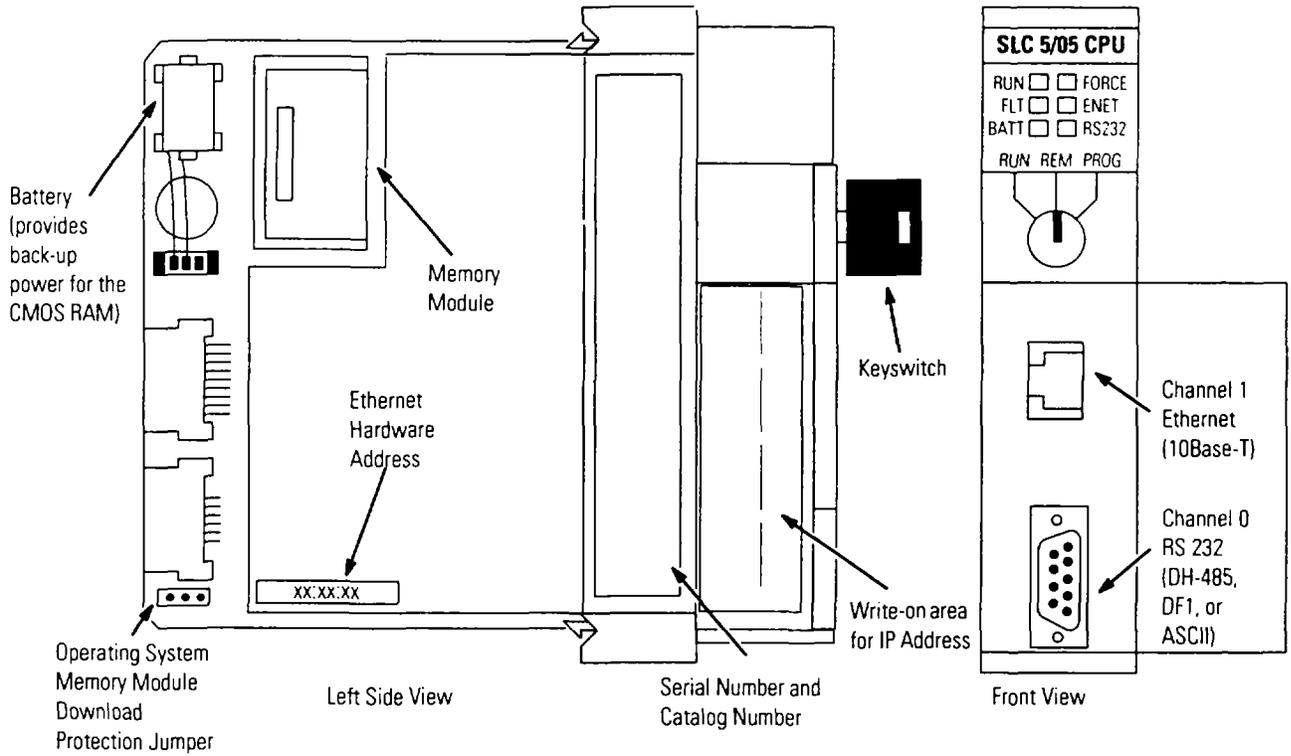
Argentina • Australia • Austria • Bahrain • Belgium • Bolivia • Brazil • Bulgaria • Canada • Chile • China, People's Republic of • Colombia • Costa Rica • Croatia • Cyprus • Czech Republic • Denmark • Dominican Republic • Ecuador • Egypt • El Salvador • Finland • France • Germany • Ghana • Greece • Guatemala • Honduras • Hong Kong • Hungary • Iceland • India • Indonesia • Iran • Ireland • Israel • Italy • Jamaica • Japan • Jordan • Korea • Kuwait • Lebanon • Macau • Malaysia • Malta • Mexico • Morocco • The Netherlands • New Zealand • Nigeria • Norway • Oman • Pakistan • Panama • Peru • Philippines • Poland • Portugal • Puerto Rico • Qatar • Romania • Russia • Saudi Arabia • Singapore • Slovakia • Slovenia • South Africa, Republic of • Spain • Sweden • Switzerland • Taiwan • Thailand • Trinidad • Tunisia • Turkey • United Arab Emirates • United Kingdom • United States • Uruguay • Venezuela

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The figure below shows some of the hardware components of the SLC 5/05 processors (1747-L551, 1747-L552, and 1747-L553).



The table below provides a general explanation of the processor status LEDs.

Processor LED	When It Is	Indicates that
RUN (Color: green)	On (steady)	The processor is in the Run mode.
	Flashing (during operation)	The processor is transferring a program from RAM to the memory module.
	Off	The processor is in a mode other than Run.
FLT (Color: red)	Flashing (at power up)	The processor has not been configured.
	Flashing (during operation)	The processor detects a major error either in the processor, chassis, or memory.
	On (steady)	A fatal error is present (no communications).
	Off	There are no errors.
BATT (Color: red)	On (steady)	The battery voltage has fallen below a threshold level, or the battery is missing or not connected.
	Off	The battery is functional.

Processor LED	When It Is	Indicates that
FORCE (Color: amber)	Flashing	One or more input or output addresses have been forced to an On or Off state but the forces have not been enabled.
	On (steady)	The forces have been enabled.
	Off	No forces are present or enabled.
ENET Channel 1 (Color: green or red)	Solid Green	The Ethernet port is functioning properly and is connected to an active Ethernet network.
	Flashing Green	The Ethernet port is functioning properly, connected to an active Ethernet network, and is transmitting packets.
	Flashing Red	A hardware or software fault has occurred and is being reported via a code. Contact Allen-Bradley Global Technical Services for assistance.
	Off	No Ethernet connection or processor halted.
RS-232 Channel 0 (Color: green)	On (steady) DF1/ASCII Mode	The SLC 5/05 processor is transmitting on the network.
	Off DF1/ASCII Mode	The SLC 5/05 processor is not transmitting on the network.
	On (steady) DH-485 Mode	The Channel 0 Communications Active Bit (S:33/4) is set in the System Status file and the processor is actively communicating on the network.
	Flashing DH-485 Mode	The processor is trying to establish communications, but there are no other active nodes on the DH-485 network.
	Off DH-485 Mode	A fatal error is present (no communications).

## Discrete I/O Module Summary

	ID Code	Voltage Category	Catalog Number	Input/Output	I/O Points	Module Description	Page
AC Modules	100	100/120V ac	1746-IA4	Input	4	120V ac Input	15
	300	100/120V ac	1746-IA8	Input	8	120V ac Input	15
	500	100/120V ac	1746-IA16	Input	16	120V ac Input	15
	101	200/240V ac	1746-IM4	Input	4	240V ac Input	15
	301	200/240V ac	1746-IM8	Input	8	240V ac Input	15
	501	200/240V ac	1746-IM16	Input	16	240V ac Input	15
	2703	100/120V ac	1746-OA8	Output	8	120/240V ac Output	17
	2903	100/120V ac	1746-OA16	Output	16	120/240V ac Output	17
	2803	120/240V ac	1746-OAP12 <sup>(1)</sup>	Output	12	High Current 120/240V ac Output	17
	306	24V dc	1746-IB8	Input	8	Current Sinking DC Input	19
	506	24V dc	1746-IB16	Input	16	Current Sinking DC Input	19
	706	24V dc	1746-IB32 <sup>(1)</sup>	Input	32	Current Sinking DC Input	19
	519	24V dc	1746-ITB16	Input	16	Fast Response DC Sinking Input	19
	509	48V dc	1746-IC16	Input	16	Current Sinking DC Input	22
	507	125V dc	1746-IH16	Input	16	Current Sinking DC Input	22
	320	24V dc	1746-IV8	Input	8	Current Sourcing DC Input	22
	520	24V dc	1746-IV16	Input	16	Current Sourcing DC Input	22
	720	24V dc	1746-IV32 <sup>(1)</sup>	Input	32	Current Sourcing DC Input	22
518	24V dc	1746-ITV16	Input	16	Fast Response DC Sourcing Input	22	
515	5V dc/TTL	1746-IG16 <sup>(2)</sup>	Input	16	Current Sourcing TTL Input	27	
2619	24V dc	1746-OB6EI	Output	6	Isolated Sourcing DC Output	31	
2713	24V dc	1746-OB8	Output	8	Current Sourcing DC Output	28	
2913	24V dc	1746-OB16	Output	16	Current Sourcing DC Output	28	
2920	24V dc	1746-OB16E <sup>(1)(3)</sup>	Output	16	Current Sourcing DC Output	31	
3113	24V dc	1746-OB32 <sup>(1)</sup>	Output	32	Current Sourcing DC Output	28	
3120	24V dc	1746-OB32E <sup>(1)</sup>	Output	32	Current Sourcing DC Output	31	
2721	24V dc	1746-OBP8 <sup>(3)</sup>	Output	8	High Current Sourcing DC Output	31	
2921	24V dc	1746-OBP16 <sup>(1)</sup>	Output	16	High Current Sourcing DC Output	35	
2714	24V dc	1746-OV8	Output	8	Current Sinking DC Output	37	
2914	24V dc	1746-OV16	Output	16	Current Sinking DC Output	37	
3114	24V dc	1746-OV32 <sup>(1)</sup>	Output	32	Current Sinking DC Output	37	
2922	24V dc	1746-OVP16 <sup>(1)</sup>	Output	16	High Current Sinking DC Output	40	
2915	5V dc/TTL	1746-OG16 <sup>(2)</sup>	Output	16	Current Sinking TTL Output	41	
DC Modules	510	24V ac/dc	1746-IN16	Input	16	24V ac/dc Input	42
	2500	AC/DC Relay	1746-OW4 <sup>(1)</sup>	Output	4	Relay (Hard Contact) Output	43
	2700	AC/DC Relay	1746-OW8 <sup>(1)</sup>	Output	8	Relay (Hard Contact) Output	43
	2900	AC/DC Relay	1746-OW16 <sup>(1)</sup>	Output	16	Relay (Hard Contact) Output	43
	2701	AC/DC Relay	1746-OX8 <sup>(1)</sup>	Output	8	Isolated Relay Output	43
	800	In - 120V ac, Out - Relay	1746-IO4 <sup>(1)</sup>	Input/Output	2 In, 2 Out	Combination Input/Output	45
	1100	In - 120V ac, Out - Relay	1746-IO8 <sup>(1)</sup>	Input/Output	4 In, 4 Out	Combination Input/Output	45
	1500	In - 120V ac, Out - Relay	1746-IO12 <sup>(1)</sup>	Input/Output	6 In, 6 Out	Combination Input/Output	45
	1512	In - 24V dc, Out - Relay	1746-IO12DC <sup>(3)</sup>	Input/Output	6 In, 6 Out	Combination Input/Output	45

(1) Certified for Class 1, Division 2 hazardous location by CSA only

(2) Not CE marked

(3) These modules carry the C-UL mark and are certified by UL per CSA only

## Specifications

This appendix lists the specifications for the 1746-NI8 Analog Input Module.

### Electrical Specifications

Description	Specification
Backplane Current Consumption	200 mA at 5V dc 100 mA at 24V dc
Backplane Power Consumption	3.4W maximum (1.0W @ 5V dc, 2.4W @ 24V dc)
Number of Channels	8 (backplane isolated)
I/O Chassis Location	Any I/O module slot except slot 0
A/D Conversion Method	Successive approximation, switched capacitor
Input Filtering	Low pass digital filter with programmable filter frequencies
Normal Mode Rejection (between [+] input and [-] input)	Provided by low-pass filter
Common Mode Rejection (between inputs and chassis ground)	Greater than or equal to 75 dB at DC Greater than or equal to 100 dB at 50/60 Hz
Input Filter Frequencies	1 Hz 2 Hz 5 Hz 10 Hz 20 Hz 50 Hz 75 Hz
Calibration	The module performs continuous autocalibration.
Isolation	50V dc continuous between the analog inputs and the backplane 530V ac and 750V dc pulse withstand for 1 second
Common-Mode Voltage Range	±10.5V (21V maximum between any two terminals)

### Physical Specifications

Description	Specification
LED Indicators	9 green status indicators one for each of 8 channels and one for module status
Module ID Code	Class 1 Interface: 3526 Class 3 Interface: 12726
Recommended Cable	Belden #8761 or equivalent
Maximum Wire Size	Two 14 AWG wires per terminal
Maximum Cable Impedance	Voltage Source (with less than 10Ω impedance): 40Ω maximum loop impedance, for <1LSB error Current Source (transmitter properly wired to its power supply): 250Ω maximum loop impedance, to meet common-mode voltage requirements
Terminal Block	Removable, Allen-Bradley spare part Catalog Number 1746-RT25G

## Environmental Specifications

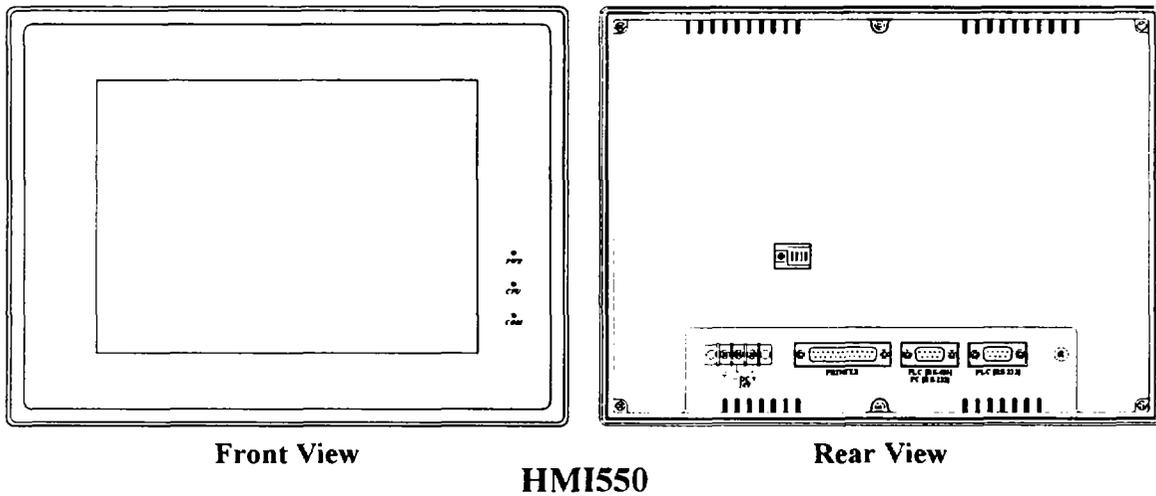
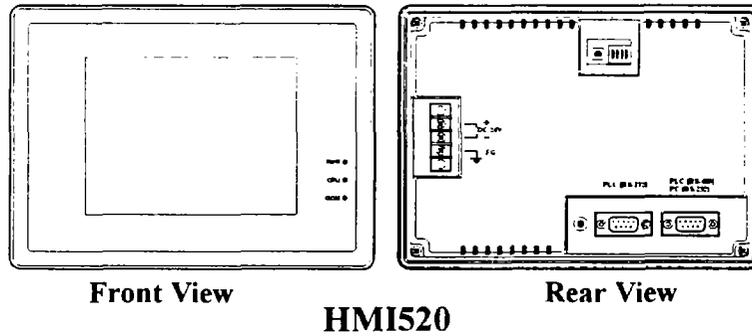
Description	Specification
Operating Temperature	0°C to 55°C (32°F to 131°F) in any slot except slot 0 0°C to 60°C (32°F to 140°F) in right most slot of chassis
Storage Temperature	-40°C to +85°C (-40°F to +185°F)
Relative Humidity	5% to 95% (without condensation)
Certification	UL listed CSA approved CE compliant for all applicable directives
Hazardous Environment Classification	Class I Division 2 Hazardous Environment

## Input Specifications

Description	Specification
Type of Input (Selectable)	± 10V dc 1-5V dc 0-5V dc 0-10V dc 0-20 mA 4-20 mA ± 20 mA 0-1 mA
Type of Data (Selectable)	Engineering Units Scaled-for-PID Proportional Counts (-32,768 to +32,767 range) Proportional Counts (User Defined Range, Class 3 only) 1746-NI4 Data Format
Input Impedance	1 MΩ
Voltage Input (maximum)	±30V between any two signal terminals
Current Input (maximum)	±30 mA
Time to Detect Open Circuit	1 module scan
Input Step Response	See Chapter 4, Channel Filter Frequency Selection, page 4-7
Input Resolution	1 mV or 1 μA
Display Resolution	1 mV or 1 μA
Overall Module Accuracy (0°C to 60°C, 32°F to 140°F)	Voltage input types (± 10V dc, 1-5V dc, 0-5V dc, 0-10V dc): ±0.1% Current input types (0-20 mA, 4-20 mA, ± 20 mA): ±0.05% Current input type (0-1 mA): ±0.5%
Overall Module Drift	Voltage input type: ±6 ppm/°C Current input type: ±12 ppm/°C
Module Update Time	See Chapter 4, Update Time, page 4-5
Channel Turn-On Time	See Chapter 4, Turn-On Time, page 4-6
Channel Turn-Off Time	See Chapter 4, Turn-Off Time, page 4-6
Channel Reconfiguration Time	See Chapter 4, Reconfiguration Time, page 4-6

### What is an HMI500 Series OIT?

The HMI500 Series of OITs by Maple Systems are graphics operator interface designed to connect to PLCs in an industrial environment. The 5.7" displays are covered with a 4-wire analog resistive touch screen designed for harsh industrial environments. The 10.4" and 7.7" displays are covered with an 8-wire analog resistive touch screen. The touch screen utilizes the latest in touch screen technology enabling the OIT programmer to create switches that are very fine in resolution. Unlike many other touch screen OITs on the market, the HMI500 Series is not limited to a fixed number of cells in which switches can be created. The OIT programmer can create as many switches of varying sizes and shapes as he wishes, limited only by the total amount of memory available for the project.



Three LED indicators are provided on the face of the HMI500 Series OIT to provide instant feedback to the OIT operator of the current operating condition of the OIT.

LED Indicator	Function
PWR LED (yellow)	indicates if power is applied to the OIT
CPU LED (green)	indicates if the OIT is operating correctly
COM LED (red)	indicates communications activity on PLC port

The HMI500 Series OIT has two serial ports, which provide a connection to a PLC using RS-232 or RS-485 communications and an RS-232 connection to a computer for programming. The serial ports also provide the ability to connect multiple OITs in series to a single PLC port! The two serial ports also provide the ability to use the EZware-500 configuration software in Simulation Mode enabling the OIT programmer to test his project on the PC instead of downloading the project to the OIT.

The HMI500 Series is powered using +24VDC. A contrast switch is provided to adjust the viewing level of the OIT display. Finally, a reset switch is provided on the back of the OIT to reinitialize the OIT if an operational failure occurs. The HMI500 Series is designed for industrial environments and carries a NEMA 4 rating as well as CE compliance for noise immunity and emissions.

There are currently eight models in the HMI500 Series.

Model	Display Size	Resolution (pixels)	Display Type	Brightness (cd/m <sup>2</sup> )	Contrast	Recipe/RTC Module
HMI520M-001	5.7"	320 x 240	4-shade blue-mode STN	60	15:1	No
HMI520C-001	5.7"	320 x 240	256-color STN	150	30:1	No
HMI530C-001	7.7"	640 x 480	256-color DSTN	150	30:1	No
HMI530C-002	7.7"	640 x 480	256-color DSTN	150	30:1	Yes
HMI550C-001	10.4"	640 x 480	256-color DSTN	150	30:1	No
HMI550C-002	10.4"	640 x 480	256-color DSTN	150	30:1	Yes
HMI550H-001	10.4"	640 x 480	256-color TFT	250	100:1	No
HMI550H-002	10.4"	640 x 480	256-color TFT	250	100:1	Yes

Finally, the HMI500 Series are powered by a 133 MHz 32-bit RISC processor, making it one of the fastest OITs available on the market. Even the most complicated graphics can be displayed quickly on the OIT screen. In addition, the OIT uses a proprietary algorithm to find the most efficient means of extracting data from the PLC. This lowers the amount of 'bottleneck' time due to the relatively slow communications baud rate of most PLCs. Therefore, the update rate to gather information from the PLC is very fast.

## Appendix A - Specifications

### HMI520:

#### **Mechanical**

Material: ABS housing with polyester overlay & neoprene gasket  
Mounting: Panel, 1/8 inch [3.2mm] nominal thickness  
Wiring: Two 9-position shielded D-sub serial communications connectors plus power connector  
Weight: 2.2 pounds [1 kg]

#### **Environmental**

Protection: Sealed to NEMA 4/12 when properly panel mounted  
Operating Temperature: +32 to +113° F [0 to 45° C]  
Storage Temperature: -4 to +140° F [-20 to 60° C]  
Operating Humidity: 10-90% RH (non-condensing)

#### **Electrical Noise Emissions and Immunity**

Emissions: EN55011 (Group 1, Class B)--Generic commercial, light & heavy industrial environments  
EN50081-1 Generic domestic and light industrial environments  
EN50081-2 Generic heavy industrial environments  
Immunity: EN50082-1 Generic domestic and light industrial environments  
EN50082-2 Generic heavy industrial environments

#### **Power Requirements**

Input Voltage: 24 VDC  $\pm$  5%  
Input Current: 1 amp instantaneous, 500 milliamps continuous

#### **Display**

Type: Liquid Crystal Display (LCD), 320 x 240 pixels  
Size: 5.7 inches [145mm] diagonal  
Backlight: CCFL with 15,000 hour minimum lifespan  
*HMI520M*: 4-shade blue-mode STN, 60 cd/m<sup>2</sup>, 15:1 contrast  
*HMI520C*: 256-color STN, 150 cd/m<sup>2</sup>, 30:1 contrast

#### **Touchscreen**

Type: 4-wire analog resistive  
Touch Accuracy: 0.08 inches [2mm] resolution  
Surface Hardness: 4H

#### **Communications**

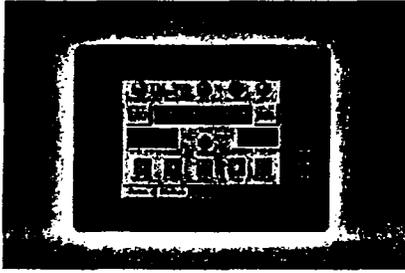
Serial ports: Port 1 is RS-232 communications to PLC (DE9S)  
Port 2 is RS-485 communications to PLC and RS-232 PC configuration (DE9P)  
Baud Rates: 9600, 19200, 38400, 57600, 115200  
Type: Point-to-point serial communications

#### **Internal Features**

Microprocessor: 133 Mhz 32-bit RISC  
Memory: 4MB DRAM, 1MB flash

# HMI520C

## Product Specifications



## Hardware Specifications

### Display

**Type** — 256-color STN  
**Size (Angle)**— 5.7 inches [145 mm]  
**Size (W x H)** — 4.5 x 3.5 inches [114 x 89 mm]  
**Resolution** — 320 x 240 pixels  
**Brightness** — 150 cd/m<sup>2</sup>  
**Contrast** — 30:1  
**Backlight** — CCFL with 15,000 hour minimum life span

### Touchscreen

**Type** — 4-wire analog resistive  
**Touch Accuracy** — 0.08 inches [2 mm]  
**Surface Hardness** — 4H

### Hardware

**Microprocessor** — 133 MHz 32-bit RISC  
**Flash Memory** — 1 MB  
**DRAM** — 4 MB  
**Non-volatile Recipe RAM** — 1 MB  
**Real-Time Clock Chip**— standard

### Physical Dimensions

**Height** — 5.9 inches [150 mm]  
**Width** — 8.0 inches [204 mm]  
**Total Depth** — 2.0 inches [51 mm]

### Panel Cutout and Dimensional Drawings

### Mechanical

**Material** — plastic ABS  
**Mounting** — panel  
**Wiring** — field-wired to external terminal strip for power and D-style communication connectors  
**Weight** — 2.2 pounds [1 kg]

## Environment

**Ratings** — IP65, NEMA 4

**Operating Temperature** — 32 to 113° F [0 to 45° C]

**Storage Temperature** — -4 to 140° F [-20 to 60° C]

**Relative Humidity** — 10% to 90% (non-condensing)

**Voltage Resistance** — 500VAC (1 minute)

**Isolation Resistance** — exceed 50Mohms at 500VDC

**Vibration Endurance** — 20 to 25 Hz (x,y,z direction; 2G; 30 minutes)

## Certifications

**CE** complies with EN50081-2 (1993) & EN50082-2 (1995)

## Power Requirements

**Input Voltage** — 24 VDC

**Power Requirements** — 48 watts typical (2 amps @ 24VDC)

## Communication

**Serial Port 1 (OIT Configuration & RS-485 Communications)** — RS-232 or RS-485 (DE9P)

**Serial Port 2 (RS-232 Communications)** — RS-232 (DE9S)

**Baud Rates** — 115.2K, 57.6K, 38.4K, 19.2K, 9600

**Type** — point-to-point

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## Operating Specifications

### Screens & Pop-up Windows

- Up to 245 user-definable screens (full size) or pop-up windows (partial size)
- Up to 6 pop-up windows can be displayed at one time
- Pop-up windows can overlap
- Pop-up windows can be minimized to the task bar or moved by the operator
- User-definable startup screen
- User-definable common window for displaying objects that should always be shown
- Fast selection window for quick access to screens
- Change screens or call pop-up windows using PLC registers or function keys

### Touchable Objects

- Can be any size
- Place any number in a screen or pop-up window
- Locate anywhere in a screen or pop-up window

### Graphic Objects

- Drawing tools for lines, rectangles, circles, arcs and polygons

- 256-colors available
- Overlay existing graphics to create complex graphics
- Create two-state graphics to represent PLC coils
- Create multi-state graphics to represent PLC registers

## Graphic Libraries

- Include more than 500 of the most common symbols
- Store new graphics in the libraries
- Use the same libraries in multiple projects
- Import preexisting bitmaps (up to 256 colors)

## Text

- Eight font sizes
- Display in 256-colors
- International characters available
- Character set can be modified to include special characters of your creation

## Function Keys

- Display a new or previous screen
- Display or close a pop-up window
- Display a message board
- Edit a PLC register using numbers or ASCII characters

## Bar Graphs

- Display with or without a background shape
- Define the direction - up, down, left, right
- Constant or variable hi/lo alarm limits
- Adjustable color, size, span and zero reference
- Unlimited number of bar graphs per screen

## Meters

- Four formats - up half, full up, full bottom,  $\frac{3}{4}$  full
- Adjustable color, size, span and zero reference
- Unlimited number of meters per screen

## Trends

- Periodically retrieve data from up to 16 PLC registers
- Vary sampling time from 1 to 65,535 seconds
- Hold feature for pausing the sampling
- Single or multiple page display
- Adjustable color and size

## Alarms

- Monitor an unlimited number of PLC registers and coils
- On-screen alarm indicator
- Horizontal scrolling bar scrolls through all active alarms
- Alarm list displays all active alarms

## Events

- Monitor PLC coils or registers for "events"
- Display screens or pop-up windows on an event trigger (the screens can be configured to set PLC coils)
- Acknowledge and "return to normal" capabilities

## PLC Register Control

- Decimal, hex, binary, or floating point representation
- Linear scaling to present analog or digital data in readily understandable terms (i.e., degrees, speed)
- Jogging capability - incremental or time rated
- Use single or multi-state graphics to represent
- Masked format for password protection

## Other Features

- Animated object movement using multi-state graphic objects tied to a PLC register
- On-line simulation mode for quick debugging
- Multiple OITs easily connected to one PLC
- Message board for writing messages
- Backlight screen saver
- Standard recipe and RTC

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